

July 17, 1961

# Aviation Week

*and Space Technology*

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*Photo: Left stage filament winding machine and right, development of Goodyear's new 32" x 24" computer-controlled pattern and index refines. Right angles? Take your pick from 0° to 90°.*

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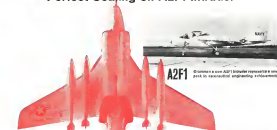
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### AVIATION CALENDAR

- July 24-26—Air Traffic Control Institute, Newport, Rhode Island; Newport Hotel, Wash. and D.C.
- July 27-Aug. 10—International Trade Fair and Aviation Exhibition, McCormick Plaza, Exposition Center, Chicago, Ill.
- July 18-20—Annual Convention, Southern California Trades Assn., Sheraton Hotel, Los Angeles, Fla.
- July 31-Aug. 31—Conference on Plans of the Sales System and Factors, Douglas Co. Information Center, Conference Room, Room 300, Helden Hall, Virginia Polytechnic Institute, Blacksburg, Va.
- Aug. 1-3—Aviation Week, American Society of Aeronautical Engineers, Sheraton Hotel, San Francisco, Calif.
- Aug. 14-16—Annual U.S. Aircraft Manufacturing Conference, Wichita, Kan.
- Aug. 24—Seminar Meeting on Newcomer Applicants to Helicopter Flight Test, Military Aeronautics Society, San Francisco, Calif.
- Aug. 24—North Coast States Airport Managers Conference, Santa Ana, Calif.
- Aug. 25—Conference and Navigation Conference, American Rocket Society, Stanford University, Palo Alto, Calif.
- Aug. 19-21—Congress Engineering Council, University of Maryland, Ann Arbor, Mich.
- Aug. 19-21—International Aerospace Conference, American Society of Mechanical Engineers, New York, N.Y.
- Aug. 19-21—Institute of the Aerospace Society, New American Meeting, San Francisco, Calif.

(Continued on page 6)

### AVIATION WEEK and Space Technology

July 17, 1981  
Vol. 75, No. 3

Aviation Week and Space Technology is a comprehensive guide to the latest in aircraft and space technology. It includes information on new aircraft, space technology, and more. The guide is published by the American Society of Aeronautical Engineers (ASAE) and is available for purchase from the ASAE Bookstore. The guide is a valuable resource for anyone interested in the latest in aircraft and space technology.

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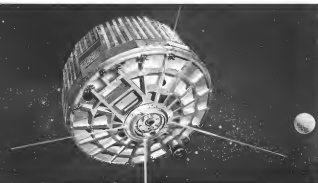
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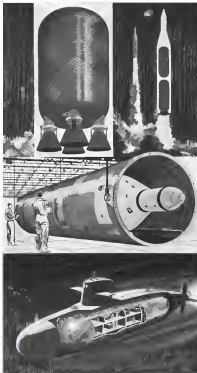
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July 17, 1961

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**COVER:** Russian instrument landing system developed by A.I. Dvornik of Gorky University to provide precision and increased glide, shown guidance for all-weather landing in down order for at Moscow's Field Long Island, N.Y. (see page 37).

**COVER:** Russian instrument landing system developed by A.I. Dvornik of Gorky University to provide precision and increased glide, shown guidance for all-weather landing in down order for at Moscow's Field Long Island, N.Y. (see page 37).

The entire Mercury system was designed around the safety of the astronaut. Perched atop his capsule is an escape system powered by a GCR solid-propellant rocket. It will hurl the astronaut-capsule and all-up and out of trouble should the booster fail during launch or low-altitude flight. This GCR rocket must work. It does work in more than 60 test shots, it has fired perfectly every time. This super-reliable propulsion system is one of several important solid-rocket projects now in production at GCR. In propulsion system research and development, GCR is at work on advanced programs for huge segmented boosters, hybrid rockets, ultra-high performance propellants, and a variety of other promising projects.

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WHEN THE MAN  
IN THE MERCURY  
NEEDS OUT



## EDITORIAL

### Lessons of Tushino

There are several lessons for the West to learn from the Soviet air show last week at Tushino.

First and most important is a lesson that we have failed to learn despite considerable instruction since 1955. That is, a graph that depicts all three old problems with the standards of being: accurate, honest, and useful. In the past, the U.S. has suffered between honesty and innovation and productivity achievement in these fields and instead of a shift in direction we have the opposite of "moral panic."

Since then, the first hints (even as we did the U.S. and Britain) of America's astonishing wartime research and development in the past war footing of that compared level, the Soviet have pushed research and development in that goal. In contrast, the U.S. has suffered between honesty and innovation and productivity achievement in these fields and instead of a shift in direction we have the opposite of "moral panic."

Tushino 1961 proved again that the Soviets have developed a tremendous capability in the modern technologies of supercomputers, rocket propulsion and space technology. The new designs exhibited at Tushino, such as Bion, Bionder and the big new MiG-25 long range interceptors are highly original and have no counterparts in the Western air force.

The lack of aerodynamics are the same the wide world over, but it is obvious from this Tushino show that the Soviets have gone far past their earlier post war emphasis in copying the West (the B-29 and DC-3, for example) and are now well on their own in even areas associated with supercomputer flight and modern aircraft armament and subsystems.

Although it would be hard to find a more beautiful aerodynamic design anywhere in the world than the big team jet Bionder, it is not so in the basic design field that Soviet progress was most evident at Tushino. True, the speeds have increased another generation (in the MiG-25 plus class, and the almost jet engines are even bigger with 45,000 lb thrust turbojets operating in the onboard nacelles of the Bionder. But it is in the refinements of the subsonic to supersonic high performance aircraft that Tushino even with its brief "dry land" glimpse of the latest aircraft revealed the most significant Soviet progress.

This has been an area in which they have admittedly lagged in the past. But a trained engineer examining the photographs on pages 28-30 in this issue of Aviation Week will find significant if not all inclusive evidence that the Soviets have advanced more than a generation in airborne radar, air conditioning systems, armament and a number of the other vital subsystems areas.

Another lesson to be learned from the 1961 Tushino show is that the Soviets make their progress in modernized small increments of logical technical progress rather than with any of the super magic that we have

come to demand and expect from our technicians in a substitute for consistent defense policy and adequate funding over the long pull. The prototypes that we saw first at Tushino in 1956 are now all operational and some with the newer modifications that reflect any good prototype into a serviceable combat plane.

The supercomputer flightlights, both in their attack bomber and all-weather interceptor versions, obviously have been in service for some years now, as have the MiG-25, Fulcrum, Fitter and Fagot fighters. The trend from the predominantly day fighter Red Air Force of 1956 to the all-weather defense force of 1961 is marked, and it is obvious that special measures have been taken to try to avoid the heart-breaking experience of having U-2s left exposed over the Soviet air space for years.

It will do little good for U.S. public officials to try to denigrate these Soviet achievements displayed at Tushino. We have been assured by many top public officials during the past six years that these achievements were only illusions and would in fact never materialize. But this "lie" and it is too late in the game for any sense of this famous nothing trap.

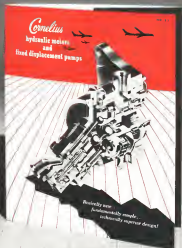
The first line of USAF all-weather interceptors will get no consolation from this gap at Tushino for their task of coping with a supercomputer armament of Bionder and Bionder, followed by a series of Bionder stand off missiles. The bomber crews of Strategic Air Command will not find it helpful in making their post-nuclear problems against the new long-range interceptors, such as Bionder and the MiG-25.

But the biggest lesson of all that we must learn from Tushino is the utter and complete futility of trying to repeat a rational defense on the whimsical basis of technical ideas in an answer effort to achieve solid national security without having to pay the full price for it. We have been offered "wonder weapons" that will solve all our defense problems (great economy) in an endless succession during the past decade. And we have chased these technical hells without any regard to what, even the broad development of overall military power.

As a result, we now face the Berlin crisis and the others that are left to follow badly off defense in our defense structure, able to cope with only one type of arms and much to be wary of both, as an other kind or a mix, have forced.

How we can pull this degraded defense structure back into a solid platform—able to cope with today's problems today, and developing the solution to tomorrow's problems for tomorrow—is perhaps the most critical problem facing President Kennedy and his "brain trust." It is difficult to see how, college professors and computer operators will be able to solve these hard research, engineering and military problems in the time we appear to have remaining.

—Robert Hottel



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## WHO'S WHERE

### In the Front Office

**Frank L. Minge**, a director of Wyoming Airco, Inc., 2000 E. 10th, Cheyenne, Wyo., is planning **Griffin A. Price**, assigned. Mr. Minge is head chairman and chief executive officer of Wyoming Airco. Mr. Price is head chairman of Wyoming Airco.

**Carroll D. Thomas**, Corp., 301 West 10th, Cheyenne, Wyo., is planning **Griffin A. Price**, assigned. Mr. Thomas is head chairman and chief executive officer of Wyoming Airco. Mr. Price is head chairman of Wyoming Airco.

**DWAF Co.**, 1000 E. 10th, Cheyenne, Wyo., is planning **Griffin A. Price**, assigned. Mr. D. W. A. F. Co. is head chairman and chief executive officer of Wyoming Airco.

**Kenneth M. Land**, vice president, is planning and purchasing **Bartholomew Co.**, 1000 E. 10th, Cheyenne, Wyo.

**Apex General Corp.**, 1000 E. 10th, Cheyenne, Wyo., is planning **Griffin A. Price**, assigned. Mr. Apex General Corp. is head chairman and chief executive officer of Wyoming Airco.

**Dr. L. Charles Foster**, vice president, is planning **Griffin A. Price**, assigned. Mr. Dr. L. Charles Foster is head chairman and chief executive officer of Wyoming Airco.

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## INDUSTRY OBSERVER

**Air Force SCARIST development plan** (AW July 14 p. 19) calls for a VTOL aircraft with maximum *level* range of 1,250 mi. It would be carried piggyback by a C-130-class aircraft to a battlefield area where it would be launched to carry supplies to a combat area, then return to its mother aircraft. It could also carry supply loads between mother aircraft and combat units. Development period for the VTOL aircraft would be 5 yr.

**Swiss government acquisition** for a substantial number of Bristol/Folland Blackhawk 3-axis-tail rotor helicopters are in advanced stages. Swiss talks with British Aircraft Corp. follow an order from the Swiss air force, which previously had bought a small number of Blackhawk 1 models. Mark 2 version has continuous wave radar, and the Bristol 3-axis-tail rotor has been modified for higher performance at low altitudes and slower speeds.

**Scramjet, initiation and perhaps a crisis** of the diffused Fokker variable sphere will be observed in Project Big Shot with a television camera mounted on the tail of the Thor booster, which will launch the sphere to an altitude of 50 mi. in a ballistic test flight. The booster will have a post-burnout attitude control system to keep the nose pointed on the trajectory.

**Batteries which weigh less than 5 lb.** but can deliver 1,000 watts of power for 10 min. has been developed by the Naval Ordnance Laboratory at Corona, Calif. The new battery, which uses thin film and semiconducting materials, has the advantage of being relatively unaffected by hostile particle streams. Melpar is designing prototype models under Bureau of Naval Weapons sponsorship.

**India is considering redesigning** two Sikorski S-63 helicopters after running into problems with the Russian Mil Mi-8 helicopters it bought (AW Feb. 28 p. 20). The Indian air force has one helicopter-powered S-63, and an order probably would involve another one.

**First operational version** of Northrop Northstar's 616 Tracer all-weather autonomous test set, developed to check out Palant systems on reconnaissance, is being ordered to meet a Feb. 31 Northstar delivery deadline. Earlier version, which is ahead the USS Compt. Washington, is a reconnaissance version of the test set.

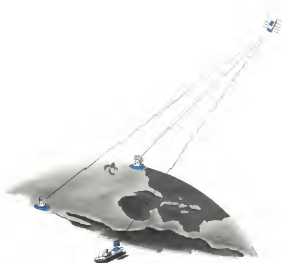
**National Aeronautics and Space Administration** has decided to measure Mercury astronaut blood pressure (AW July 10 p. 19) with the gamma spectroscopy. Call issued to an air bag will be inflated automatically during critical flight periods and the arterial reading will be taken with a manometer, amplified and recorded on film.

**First flight of the Indian-built Aero 746** has been postponed from July this month to mid-October. Delay is due to racial intertribe problems caused by the climate of the Kargil factor where the aircraft is being made. Facilities have been modified to solve the problem. Operation of the 746 also must wait until its British counterpart receives its own maintenance certificate. Indians will produce a Mark 1 version, powered by the Rolls-Royce Dart 6, and a Mark 2 powered by the Dart 7.

**Industry will submit proposals** to Aerospace Corp. late in August for development of Vela H-1 satellites for detection of nuclear explosions in connection with the Comprehensive Nuclear-Test-Ban Treaty. The program will require a substantial amount of research and development. Specific funding for the program has been established.

**Highly Aircraft Co.** has been selected by Air Force Special Weapons Center to develop special reconnaissance-type detection equipment for the Soviet modernization and inspection satellite (AW June 12 p. 15), for which RCA is prime contractor. This equipment will be designed to distinguish between man-made, natural and other satellites.

**Shifting the earth's orbit** is the aim of a series of changing the earth's orbit. The earth's orbit has been proposed by Soviet Aerospace Co. (Petersburg) for the shift would come from the proposed changes in the orbit. The shift would come from the proposed changes in the orbit. The shift would come from the proposed changes in the orbit.



**ADVENT OF A NEW ERA IN COMMUNICATIONS** will come about through the use of wide-band microwave radio repeaters in stationary satellites. Under the over all direction of the U.S. Army ADVENT Management Agency, Bendix is developing satellite repeaters and ground terminal equipment for the Army Signal Corps, and a shipboard terminal for the Navy Bureau Of Ships. This important participation in Project ADVENT exemplifies the new technical challenges and careers offered by our expanding Space Laboratory.

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## Washington Roundup

### Arms Control Studies

A panel to study the economic impact of arms control and disarm plans for managing the disruptive effects on production is being created by State Department's Disarmament Administration. It will include representatives of the President's Council of Economic Advisors and the Defense, Commerce and Labor departments, and non-governmental community.

An evaluation by the Senate Foreign Relations Disarmament Subcommittee of the effect of arms limitations on 400 firms—including 140 major defense contractors—will be the first step.

Meanwhile, the United Nations has created a panel to determine the economic implications of worldwide disarmament. Secretary-General Dag Hammarskjöld chairs the world study expedition on weapons at \$120 million.

Feasibility of the U.S. to detect underground nuclear weapons tests is expected to be highlighted at hearings before the Joint Congressional Atomic Energy Committee next week. Chairman Carl Albert will discuss recognition of tests by the U.S.

### 'Survivability' Probe

Central Intelligence Agency and Air Force and Navy intelligence witnesses will lead off closed-door hearings of the Senate Preparedness Investigating Subcommittee, scheduled to begin Feb. 15, on the state of military survival programs. Chairman John Stennis will put major emphasis on missile capabilities and on what he calls the nation's "survival ability." Defense witnesses will be called in a few weeks.

Secretary of State Dean Rusk and Secretary of Defense Robert McNamara will testify on steps under way to accelerate defense programs aimed, closely to foreign policy objectives when the Senate Subcommittee on National Policy, Madison holds hearings, now tentatively set for next week. Chairman Henry Jackson has charged that defense programs have been based almost exclusively on strategic military considerations.

House Un-American Activities Committee is still investigating the defections to Russia a year ago of two code breakers from the National Security Agency. Secret words after Russia defected in Air Force HQ of more information available, the House panel authorization appeared at a press conference in Moscow to discourage U.S. communications intelligence work.

### Next Man in Space

Next Russian manned space flight will be in orbit around the earth but will consist of more than one circuit, according to Soviet Cosmonaut Yuri Gagarin, who made the one-circuit flight last April 12. Gagarin claimed Russia would be the next country to make a manned flight because it could not make sense for the U.S. to repeat Astronaut Alan Shepard's historic flight of May 5. National Aeronautics and Space Administration, which already thinks otherwise, plans another manned ballistic flight this week.

House space committee members would like NASA to announce that it will try to send a space probe to Venus in 1962, during a Soviet space mission during congressional support for the effort. Rep. James Foley would like Shepardson on the committee, though this would rely on the technological and propaganda struggle with Russia. NASA is meeting the pressure, however, at least until it can complete a study on the technical feasibility. The agency is looking now on its launch vehicle officer from Cape Canaveral.

Success of ground reaction tests last May has turned Atomic Energy Commission to prepare a proposed flight program for the Pluto nuclear rocket. Current program covers only ground tests.

### Hitch's 'Packages'

President Kennedy's Charles J. Hitch has sent his "package" proposals, in which the historic costs of Navy and Air Force weapons programs are reduced, to the services via the Joint Chiefs of Staff. The services live with the models, at the same time prepare for meetings with the next week.

Although they are impressed by the amount of detail in the studies, the services are predicting loud cries of anguish from Congress when the cut costs required for higher priority programs, such as ballistic missiles, nuclear-powered ships and the B-70 bomber, become known.

Investigation of whether weight of the Atlas-Centaur launch vehicle can be reduced sufficiently to place Project Advent communication satellite into synchronous equatorial orbit as a ballistic or thrust booster is needed will be concluded by Defense this month. Advent-like space satellites in the development stage has been gaining weight.

Space string bonds now are getting serious consideration from the Treasury Department, which initially rejected the idea. Sen. Kenneth Keating who proposed space bonds notes that NASA has saved about 76 vibration, earthshaking savings between \$3 and \$100.

—Washington Staff



Rearly represent bomber shows Mach 2 plus design with retractable refueling probe visible just forward of cockpit to provide long range.

## Soviets Parade New Supersonic Bombers, Mach 2



Formation of heavily bombers indicates early operational status of this Mach 2 plus heavy bomber and several additional design details. Note landing gear bays make some part below fuselage are visible. Tail, side and smoothly operated barrel are visible between engine nacelles and tail fin. Multiple swept thin wings lower rear leading gear is visible. Note skidded on low set horizontal tail.



SR-71 in F-105 delta wing between SR-71 liquid fuel rocket boost with thrust control.

## Fighters, Jet Seaplanes, VTOL Aircraft at Tushino

Boards finished by two F-105 fighters reveals new design details including much larger tailpipes on lateral engines than on simply mounted outboard. Note barrel-shaped outboard nacelles and large struts added to this delta wing to support the outboard engine nacelles. Tail finning indicates large delta shape housing. Large vertical bulge near rear wheel with doors of fuselage leading gear bay and fuel and oxygen tanks at side entrance. Long fuselage has doors on side of an engine inlet between wing roots. Two did front doors of wing of delta delta wing are clearly visible.





Two views of Yakovlev Blinder (above and below) indicate Mach 2-plus performance and dual role as longrange interceptor armed with missiles as in a bomber. Note double-extended forward intakes merging into single diamond-shaped intake. Large intakes under wings and large vertical fuel tank under belly.



Ship helicopter shown above has twin rotor system with about the size of MH-4 rotor system and over 100 transport loadings with 50 passenger capacity. Note conventional vertical tail and high-mounted wing. Powerplants are Lycoming 600-hp turboprops, one housed in each wing tip pod driving both rotor system and transmission propellers.



New Mexico Mach 2-plus longrange interceptor (below) has large airframe intake in central nose as intake and carries two large air-to-air missiles. This is latest development of various failed designs aimed at countering USAR bomber threat.



Four B-57C aircraft performing aerial display fly low over Yulima beach. Note similarity to Martin P-115 design.



# Tushino Stresses USSR Aircraft Priority

First Soviet public air show of importance in five years unveils impressive array of Russian aircraft.

By Cecil Browder

Moscow-Soviet Union, displaying a wide range of design techniques, demonstrated effectively last week at Tushino that it is moving steadily ahead at near top speed in the development of manned aircraft and their related missile systems to cover all required tactical and strategic missions.

Contradicting earlier announcements by their leaders, which were based on craft to rely solely on missile systems for defense and offense, the Soviets staged their first public air show, of importance in the past five years, rolling out three supersonic bombers, two new delta-wing Mach 2-plus interceptors, a jet-powered ASW reconnaissance airplane, a conventional capable of carrying 100 troops, an advanced Kamov jet helicopter design and a flying crane.

The Soviets changed the show at Tushino, which in the Moscow suburbs, with a series of low-level maneuvers. B-15s, displaying publicly for the first time:

• **Bomber**, an exceptional, large, high delta-wing bomber of intercontinental range approximating the B-70 in size and with a supersonic dash capability in the configuration shown at Tushino. The aircraft has been flown and tested with various types of powerplants for the past two years (AW Dec. 1, 1965, p. 7); Feb. 4, p. 27). The bomber, its design credited to a group headed by Vladimir Myasishchev, has two large turbojet engines hung from pylons beneath the delta wings that render an estimated thrust of 15,000 lb. each plus two relatively smaller powerplants mounted on the wings. Large intakes suggest the aircraft shows here as a single turbojet but are believed to be turbofans. In some quickened observations, although there appears to be no visible external evidence of this. Wingtip powerplants have barrel-shaped nacelles and are assumed an extremely heavy wingtip fittings.

Bomber's spatted light bulb, joint on both the fuselage engine nacelles and then with a large bulging intake winging about 15 ft. above the main fuselage. In back of the rear wheel well down of its hock landing gear. Two pairs of visible overboard antennas were attached to the bulge. The advanced engine nacelle pylons continue above the wing in a line to control square of flow. Under the wing, the pylons of the Bomber displayed extended far beyond the engine tailpipes indicating that they may have been designed to accommodate much longer nacelles. Tailpipes of the advanced engines were about twice as large as those of the wingtip-mounted engines as the Bomber which bore the operational number 12 on its nose.

craft, designed for airborne intercept mission and missile guidance. It carried a large delta-winged air-to-air missile under each of its highly swept wings. It also had a large bulging fitting under the fuselage that appeared to be an extra fuel tank similar to the bulb fuel tank on the English Electric Lightning P-1. Cockpit indicates a two-man crew is needed. Consistent of two tailpipes were visible at the rear fuselage with the horizontal tail mounted midway on the tailpipes with a control fin extending down on each side.

• **New Mach 2-plus** interceptors, interceptors that appears to be an advanced version of the delta wing P-100 shown at Moscow's last major air show, in 1956 (AW July 2, 1956, p. 26) and developed by a team led by designer Arseny Mikoyan. A large, high, air intake in the nose, with a large, rectangular, rectangular intake that gives an air intake capability. The aircraft appears to have three distinct tailpipes, two for the main turbojets, and a third for a large, air intake. The intake below the fuselage appears to be for the aircraft the Soviets designated the "B-66" in changing world speed and altitude records of 1,335 mph and 117,294 ft (AW July 10, p. 25). On the day of the show, the Soviet press announced that the "B-66" would be on hand, but it was not publicly identified during the display. One of these advanced Mikoyan designs was shown as a high-speed pass and barrel maneuver. It carried two large air intake nacelles with circular fins and insulator control surfaces at the aircraft's tail.

• **Second Mach 2-plus** fighter also with a rocket boost system. It is a large aircraft with an oval nose section, a winging sort of fuselage and a wheel that is powered by two turbine engines. Fuselage length is an estimated 90 ft. A single aircraft was displayed here.

• **New submarine design**, including a design for a new submarine design, designed by veteran airplane builder G. M. Beriev, that is smaller but similar in external appearance to the largest Martin P5M whose development was canceled in the summer of 1955 after a total of 12 had been built, including six prototypes, two of which crashed. Engines are mounted in the winging adjacent to and on either side of the fuselage. First prototype of the aircraft, designed primarily for anti-submarine search and kill missions, was flown several years ago but the Tushino show marked its first public demonstration. Total of four B-15s participated in the show.

• **Floop**, a tail-suspended conventional plane, capable of transporting a maximum of 100 persons. Making use of a modified An-10 transport fuselage, the



Four supersonic, unarmored bomber "B-66" equipped with 300-oz. range air-to-ground guided missile, along under its specially modified belly. Note large intake near its mouth, swept wings, big fuselage showing large under wing pylons, and large jet tailpipe. Rear nose rather has been modified for missile guidance.



Mikoyan interceptors carry what Soviets said was Vostok space ship crew at Tushino. Labels are USSR and Vostok, carry picture of Yuri Gagarin on nose. Large intake on nose, swept wings, big fuselage showing large under wing pylons, and large jet tailpipe. Other interceptors carried other space ships and space probes in flight.



conventional is powered by two turbo-prop engines of an estimated 1,000 hp each, located at each wingtip. Power is connected directly to the turbo-prop power the aircraft in horizontal flight, while vertical lift is provided by two sets of rotors of four blades each, mounted above a streamlined pylon on top of each wingtip nacelle. Development of a composite is difficult, credited to Soviet helicopter designer Nikolai Kaman.

■ New turbine-gas-turbine engines, which have a thrust of 1,000 lb, are mounted above a streamlined pylon on top of each wingtip nacelle. Development of a composite is difficult, credited to Soviet helicopter designer Nikolai Kaman.

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ing vertical lift and jet propulsion, has an estimated maximum range of about 500 mi at sea. Similar but smaller air-launched missiles carried by the Bud gun have an estimated maximum range of between 50 and 100 mi.

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Landings in groups of three, one Mi-6 landed two tactical missiles while the other two brought in transport duties and other support equipment. The missiles were unloaded and placed in position within a minute's time.

Another three versions of the Mi-6, which reportedly are scheduled for only limited production, also were shown. The three versions of the Mi-6 are scheduled to be the Vostok space capsule carried by Gagarin on his orbit around the earth, another version of a Lark missile. These were the only two versions of the Mi-6 shown in a show.

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## Russians Tie Air Show to Berlin Crisis

Moscow—Top Soviet political and military leaders said last month's display of new equipment at the Tushino air show is a backdrop for new warnings to the West and all of the same time, indirect support of announced plans for reductions in the Russian armed forces.

The political parade held in the present Berlin crisis began the day before the air show and was led by Soviet Premier Nikita Khrushchev who knew what was to be seen and was riding upon enormous support. Speaking at a Kremlin reception for recent graduates of the military academy, Khrushchev repeated his determination to sign a separate treaty with West Germany if necessary, and said that the Soviet Union, "possessing the necessary quantities of thermonuclear weapons, the most efficient means of their delivery—aircraft, intermediate and intercontinental missiles."

He also said that, in case of the military buildup by North Atlantic Treaty Organization countries, he had ordered a 150,000 increase in 1964 defense spending other than planned cuts which he would bring the next session to approximately \$12 billion. Actual cuts of Soviet defense budgets are never revealed, neither is real expenditures are concerned.

Khrushchev said such a move was necessary because, as a result of defense buildup in the buildup of the armed forces in western countries, the show is necessary and, the number of missiles in America which are constantly rising in the air. The forces of West Germany are being equipped with the latest weapons and means of attack.

At the same reception, Defense Minister Marshal Rodion Malinovsky stated that "we shall continue reducing still further our military expenditures, reducing equipment one year with first class, up-to-date weapons because we are equipped to do so by the aggressive forces of imperialist states."

In an article in Pravda on the day of the show, Chief Air Marshal Konstantin Voronkov took pains to make a tactical reference to elements by Premier Khrushchev at the same following the first Soviet military air show in 1957. But Khrushchev, as usual, seemed to have no hand in the show.

It is only stated that with the development of a new type of weapons—rockets—the air force continues to play a great role, rather the other hand.

The Soviet Union does not forget the progress of current designs and programs that have no equal in the world for speed, altitude and range of flight.

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on large, high-integration, high-capacity, and on the ground, as well as in the air. The Soviet designers are based in the city of Moscow, near the city of Moscow, near the city of Moscow.

Landings in groups of three, one Mi-6 landed two tactical missiles while the other two brought in transport duties and other support equipment. The missiles were unloaded and placed in position within a minute's time.

Another three versions of the Mi-6, which reportedly are scheduled for only limited production, also were shown. The three versions of the Mi-6 are scheduled to be the Vostok space capsule carried by Gagarin on his orbit around the earth, another version of a Lark missile. These were the only two versions of the Mi-6 shown in a show.

■ New turbine-gas-turbine engines, which have a thrust of 1,000 lb, are mounted above a streamlined pylon on top of each wingtip nacelle. Development of a composite is difficult, credited to Soviet helicopter designer Nikolai Kaman.

Mikhail Mi-6's long range drops demonstrate cargo capacity by lifting professional horse car of U. S. railroad freight car. Note external fuel tank hanging from tail-pipe of two jet-powered missiles and unusual cockpit configuration. Katerina appears to be the same in Mi-6 but transport type cabin is of a smaller diameter.







## Raytheon's Advanced Systems for Mauler... Operational in ANY Mobile Surface Environment

Mauler is the United States Army's new automating its defense system radar development by Comair/Permacon, Comair Division of General Dynamics Corporation. It will be highly mobile and will track targets and launch missiles on the run from virtually any position.

Raytheon provides the Mauler System's self-contained Detection and Fire Control Radar. These radars are capable of detecting missiles against redangle targets and of fast reduction of fire. Raytheon also supplies Mauler's Acquisition Radar and Target Data

Processing Components. For these radars and components, Raytheon has developed advanced maintenance techniques.

Mauler radars are the most recent example of Raytheon's reliability in extreme environments. They are an outgrowth of Raytheon's pioneering in the development of detection and fire control radars for the Sparrow, Hawk, and Tartar weapons systems.

For any mobile surface requirement, Raytheon offers proven capabilities in design, development and manufacture of reliable radar systems.

**RAYTHEON COMPANY**

EQUIPMENT DIVISION

**RAYTHEON**

secret to one was prompted by Prince Khrushchev's announcement that Russia would increase its military spending not by the Mavrova rate alone (see p. 81). The review was ordered July 8, Galtore said the same day Khrushchev said the Soviet military budget is going to be increased in 1963 by 3,144,000,000 rubles to 12,990,000,000.

At a press conference July 21, Galtore said the latest Defense Department review "is directed primarily at the propaganda measures which would be taken in the near future—in a matter of months—looking toward strengthening the position of one communist bloc force."

Both before the Senate subcommittee, and at his press conference, Galtore said to estimate how much money the Defense Department would require if any. But then was cautious that a reliable estimate could be sought and budget production would be assessed. Sen. Robertson reportedly told Galtore that his administration wanted to secure an agreement for more military money before it acts on the appropriations bill. Otherwise, Sen. Robertson said, the Senate would not know how much money would be available for less rapid domestic production.

Commenting on him, the Defense Department said the Russian view of Galtore was "demonstrative to what we had actually believed ourselves we did not tell Khrushchev a statement that he was coming, wanted money to develop, and he was going to ask nothing on money. It shows that the Soviet is doing what we are doing. They are going to make a demand before they know that they will be there to us for the rest of the '60s."

Galtore said that the 1963-64 B-70 and the "over 100" B-70s that the U.S. will have between 1962 and 1970 are sufficient in size as a second bomber strength throughout the 1960's.

### No B-70 Change

He said the Senate has not changed the Defense Department's stand on the B-70 program. "We still believe our present program for the B-70, which is a development program as the feasibility we need. We do not think we should change it again."

We want to have the bomber and system tested before we decide whether we want to order that sort of aircraft," Galtore said.

Rep. Scofield (D-Mo.) W. Connors (D-N.Y.), Chas. E. Taylor (D-Calif.), John Stennis (D-Miss.), S. Wright (D-Mo.) and Ralph W. Yarborough (D-Texas) introduced the Defense Department should put more stress on manned bombers.

## Tiros III Transmits Pictures, Infrared Data

Washington-Tiros III weather satellite launched successfully July 12, is transmitting clear, improved pictures of the earth's cloud cover on command and is sending infrared data continuously.

Teams of meteorologists at the Pacific Missile Range and Wallops Island, Va., received and analyzed the photographs and data and transmitted the results to high resolution terminals and videotape at the National Meteorological Center at Washington, D.C.

Tiros data is combined with other information and incorporated in the regular Weather Bureau synoptic tables which are transmitted worldwide by radio and satellite communication systems.

The infrared station at Wallops Island was said to be the first time in having at that satellite's camera team. The two infrared wide angle cameras (AW) July 13, p. 30, duplicated to provide redundancy, were working perfectly right after launch and the 500 line resolution camera was operating normally. The Tiros III data is being collected and integrated in 3 hr—compared with 54 hr by the Tiros II.

NASA believes that the great performance of the wide angle camera on Tiros III was due to the lens being designed to stand more robust parts. In Tiros II, a plastic cloud was installed to protect the lens.

D. F. W. Rosenbluth, chief of the U.S. Weather Bureau, said last week that international cooperation with about 180 countries including Russia will be initiated at the successful transmission time.

Tiros III was launched on a schedule which would place it in daylight over the mid-latitude hemisphere during the height of the hurricane season in September. The satellite will alternate between hemisphere at daylight over four weeks. Tiros II is expected to fly in some of the southern hemisphere daylight hours. It is likely, however, that the satellite will be launched after July 15, after the summer, but the batteries are showing signs of wear.

Apogee of Tiros III is 430 mi. perigee is 421 mi. the inclination is 48 deg. and the orbital period is 360 min. There will be four more Tiros launches before the "Soviet satellite launch series in orbital from Pacific Missile Range with joint efforts.

Sen. Connors and the B-70 program should be placed on a "year basis" and recommended spending \$75 million in fiscal 1962 on its development—the amount the Air Force regularly requested. The Kennedy administration budget calls for \$220 million for the B-70 in fiscal 1962. President Eisenhower's last order for \$135 million.

Sen. Easton recommended that the Senate subcommittee add a provision to the House-passed appropriation bill authorizing the construction of defense, to be for the total \$225 million authorized for long-range bombers. The House-passed appropriation bill—providing for the authorization bill—provides \$445.5 million for procurement of long-range bombers (AW July 1, p. 26). It is said if Congress could not provide the defense committee to use the \$135 million to speed development of the B-70 the money then could be used for the B-70.

Sen. Stennis urged the defense committee to speed the B-70's development while Sen. Stromberg and facing to do so will mean the U.S. is "abandoning the field in which they (the Russians) have just demonstrated they have been maintaining for 10 years now," Sen. Stromberg said. "The entire question now of what we are doing in the '60s is being reversed."

Sen. Yarborough recommended that the defense committee speed the bomber can be modified to provide the

experts of a B-70. He said the \$75 billion needs of funds left to which strategic bombers could be used to increase the range of the B-70.

The Kennedy Administration did not support the use of fiscal 1962 money for the B-70 or B-75. But the House total \$445.5 million in its appropriation bill for long-range bombers in fiscal 1962, which would be built. Sen. Stennis said the authorization bill provides that the bomber money could be spent for long-range bombers—the B-72 or B-70 but not the B-46.

### Advertising Restrictions

A portion of the Senate subcommittee hearings are devoted to the attention in the House-passed defense appropriations bill concerning advertising by government contractors. The House bill states that the advertising proposed by contractors shall be available for printing the costs of advertising in any defense contract, and such costs shall not be considered a part of any defense contract cost.

Galtore said the Defense Department is "unhappy to be the purveyor of the action but felt it was too important to ignore." He recommended allowing contractors to "fully" recruit or personnel, (2) obtaining services, or (3) disposing of scrap or surplus materials. Galtore said the advertising restrictions would apply only to contractors' contracts and not to fixed price contracts.

# Broad Space System Participation Plan Expected From Space Council

Washington-National Aeronautics and Space Council was expected to issue its President's Council last week a recommendation that an independent committee be formed to appraise a commercial communications satellite system, with ownership open to nonprofit companies as well as commercial concerns.

If the President concurs with the recommendation, it could become a national policy.

The council will recommend strong authority to ensure all companies an opportunity to bid for system hardware production.

**Agencies in Agreement**

Representatives of nine interested agencies had agreed on a coordinated policy recommendation to be submitted to the national space council.

Those agencies included the Defense Department, State Department, National Aeronautics and Space Administration, Atomic Energy Commission,

Federal Communications Commission, Justice Department, Office of Civil Defense, Administration, Budget Bureau and the Treasury's Science Advisory Committee. The first line are represented on the space council, and non-defense agencies were expected to be invited to sit in during council deliberations.

**Other Developments**

Other developments in the commercial communications satellite system have included:

• Sen. Ronald B. Long (D-Kan.), chair man of the Senate Subcommittee on Manpower, announced that he would oppose limiting entry control of space communications.

• Sen. Frank Lautenberg (D-N.J.), chair man of the Senate Subcommittee on Manpower, announced that he would support limiting entry control of space communications.

• Sen. Robert F. Kennedy (D-N.Y.), chair man of the Senate Subcommittee on Manpower, announced that he would support limiting entry control of space communications.

• Sen. Charles McNair (D-Ind.), chair man of the Senate Subcommittee on Manpower, announced that he would support limiting entry control of space communications.

• Sen. Hubert H. Humphrey (D-Minn.), chair man of the Senate Subcommittee on Manpower, announced that he would support limiting entry control of space communications.

• Sen. Walter D. Dill (D-Ore.), chair man of the Senate Subcommittee on Manpower, announced that he would support limiting entry control of space communications.

• Sen. Frank E. Church (D-Idaho), chair man of the Senate Subcommittee on Manpower, announced that he would support limiting entry control of space communications.

• Sen. Warren E. Hearnes (D-Wash.), chair man of the Senate Subcommittee on Manpower, announced that he would support limiting entry control of space communications.

• Sen. Charles McNair (D-Ind.), chair man of the Senate Subcommittee on Manpower, announced that he would support limiting entry control of space communications.

• Sen. Hubert H. Humphrey (D-Minn.), chair man of the Senate Subcommittee on Manpower, announced that he would support limiting entry control of space communications.

## New Beech Lightplane

Establishment of the first prototype of Beech Aircraft Corp's new light four-place business and utility airplane, to be priced in the \$15,000 class, has been started at the company's Wichita, Kan. plant, with the airplane expected to start its flight test program before year end. Deliveries are said to begin in early 1969.

The new airplane (AWP No. 22-1909-P-50) will have a fixed tricycle landing gear. Indications are that the company has been choosing a price of approximately \$16,000.

## Research, Education Spending Boost Urged

Washington-U.S. must increase its spending for science and engineering education and for basic research in order to keep its leadership in the field, officials here said. The report, issued last week by the National Science Foundation, says the federal government has a "special responsibility" for leadership in this area and that its position of total financial support must continue.

In Fiscal 1968, the estimate basic research effort totaled \$15.5 billion, half of which was spent with universities. The federal government contributed 62% of that total, 27% came from industry and 6% came from nonprofit institutions. The remaining 12% was contributed by colleges and universities.

Basic research programs at universities and at the Federal Government will contribute the remainder of about 47,000 full-time professional personnel. The report forecasts 1970 spending of \$2.72 billion with a professional force of 35,000 and a supporting force of 67,000.

This year, there are about 108,000 professional scientists and engineers working about 645,000 scientific studies in their fields. The report predicts there will be 175,000 scientists and 115 auxiliary science and engineering students in 1970. Supporting staff would rise from the 1965 equivalent of 108,000 full-time employees to 175,000 in the same period.

Total cost of this endeavor still is about \$2.14 billion this year, and the report says it should rise to \$3.14 billion in 1970. It also says that "the government must be prepared to meet the increasing costs of research and engineering in the concrete level and that an investment of about \$1.5 billion is required over the next five years."

## Discover XXVI Recovered in Air

Recovery capsule of USAM Discover XXVI polar orbit satellite with a load of materials test specimens was successfully recovered in its orbit on July 13, 1968, which marks the completion of the mission. The capsule was launched on July 13, 1968, and was recovered on July 13, 1968, after a successful mission. The capsule was launched on July 13, 1968, and was recovered on July 13, 1968, after a successful mission.

Capsule recovered 68 mi northeast of the island of Kauai, Hawaii, contained samples of silica, iron, barium, strontium, magnesium, lithium, lead, and cesium. These were exposed to the environment of space for 50 to 74 days. The capsule was recovered on July 13, 1968, after a successful mission. The capsule was launched on July 13, 1968, and was recovered on July 13, 1968, after a successful mission.

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was a digital communication channel that will be used for data transfer.

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## News Digest

Defense Department will establish a joint intelligence agency which will be staffed by the services and will be headed by an officer of this staff. Technical and technical intelligence, however, will be left with the unified and specified commands and the three staffs.

USAF-Lockheed Model 101, experimental model, detection satellite, has been successfully launched into a polar orbit similar to the one planned for use by the first two of this series from the Naval Missile Facility, Ft. Belvoir, Calif. The satellite was also the first in the series to use an Agena-B second stage in the booster system.

Rep. Charles W. Stenholm (D-Texas) will replace Maj. Gen. John W. Carpenter, III, this month as commander of Air Force Flight Test Center at Edwards AFB.

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## Complete F-1 Engine Test Firings Begun

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## Atlas E Flies 9,050 Mi.

Washington-Atlas E, launched from Cape Canaveral, Fla., on July 13, 1968, completed a 9,050-mile flight on July 13, 1968, and was recovered on July 13, 1968, after a successful mission. The capsule was launched on July 13, 1968, and was recovered on July 13, 1968, after a successful mission.

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## Problems Loom for 'Visit USA' Program

Cost of touring America and lack of preparedness to accommodate visitors appear to be main obstacles.

By Glenn Gorman

New York—No initial wave of foreign tourists visiting the United States is expected to result from new legislation granting the federal government the authority of promoting travel to this country.

The bill passed in Congress and signed last month by President Kennedy, establishes a new United States Travel Service within the Department of Commerce with a budget of \$5 million. It calls for the creation of U.S. travel offices abroad and for cooperation in the U.S. with tourism bureaus and national agencies of the tourist industry.

Although some say "Visit USA" programs have expanded greatly in recent months, say the government more as a long-needed first step in the development of the air and scheduled foreign travel industry.

For travel officials, however, to be economic before the country, it is expected to attract a flow of tourists and tourist dollars to match the volume of U.S. tourist business overseas.

Cost of running this country is a point of concern in the travel industry. One view is that transportation (for example, with an increasing) high level of economy in many countries, it will be less than the U.S. but a projected rise of prices here. This is a problem of relocation of the U.S. economy will increase as the cost of travel and overseas instead of thinking of the United States. The other view is that costs will increase in the south of most transportation. The cost of an transportation to the U.S. is an important element. One area of opinion holds that faces must be adjusted to attract tourists from the great overseas.

Expansion of the U.S. to handle foreign tourists is one. It is held that this country is not geared for the foreign tourist travel information offices, including the linguistic barrier is formidable. American etc. "must" be turned to accommodating foreign tourists and attitudes must be changed. These problems have been greatly overstated. U.S. airlines are

• New facilities and efficient type domestic foreign airlines have seen adjustments to this country for a visit. Some progress in handling them has been made, it is reported, and new resources and possibly legislative action are being taken in the future.

A major factor in the anticipated "Visit USA" interest in the post-war period has been concern with the va-

lue in the U.S. for the last. About 1,650,000 U.S. tourists traveled in foreign countries.

With the new government program under way, a doubling of visitors to this country is expected after the first few years, according to Commerce officials.

The stated purpose of the new legislation is "to strengthen the domestic and foreign commerce of the United States and promote friendly understanding and appreciation of the United States by encouraging foreign visitors to the United States and by facilitating international travel generally." It is called "a major new effort to attract foreign visitors to the United States" by Chairman Warren G. Magnuson of the Senate Commerce Committee.

Advertising an overseas market will be a major effort of the new service. While foreign governments spend about \$10 million a year to attract U.S. tourists, the U.S. is presently faced to three times the volume of such tourists as spent by them overseas. The U.S. has never made an equal promotional effort in this direction.

Some officials of foreign travel agencies believe we will have a great challenge in making our program to what will interest European and other foreign tourists. On present, they are, in general to U.S. tourists and in large measure, to automobile travel—and a whole new approach will be necessary.

As an illustration of what the foreign tourist can find in the U.S. and how, several countries note that there is no U.S. based equivalent for the European concept, who this consider it is not a valuable source of aid and in comparison for the travel cost on the continent.

However, the view that we are ill-equipped to handle thousands of tourists is not universal. While G. Lippincott, vice president traffic and sales of Pan American, shares this opinion during hearings on the recent legislation.

Lippincott said it has become almost fashionable to specialists in the shortcomings of the U.S. travel industry and to denigrate the ability of Americans to turn to the needs of the foreign tourist. He should not wait until all day drives in Rome or Oslo hours. City leaders to speak to them before the United States set out to provide facilities to visit the United States. The goal of increasing the number of tourists to the U.S. in the next few years should not place an undue strain on our tourist plant

Lippincott and American's ability to play host will become more difficult as the demand increases.

While a mass arrival of foreign visitors is generally considered not in the future, industry report indicate numerous tourists in groups from both Europe and the U.S. are being scheduled abroad for the first time in history. The Commerce interest has developed considerable knowledge—professional or amateur groups attending conferences in their field or spending several years of instruction in foreign travel. The Commerce has about 1,000 persons last year in this field of activity.

The current interest in "Visit USA" has been stepped into the past two years, at foreign associations, conferences and the tourist industry conference. President Eisenhower proclaimed 1958 "Visit USA" year but no action was taken by the government level.

Activities have been continuing for years of interest in all fields to the country. But then efforts are necessary competitive and the general advertising and promotion of the U.S. as a destination is a power function the other tourist efforts. In accordance, all other countries have been doing for many years.

### Expanded Efforts

American's own efforts have expanded greatly in recent months. Some examples:

• Pan American's accelerated program calls for expenditure of \$4.5 million a year to promote "Visit USA." Advertising, public and tourist relations at 750 offices abroad will be used, and a whole new approach will be demonstrated.

• TWA has been opened its own travel information bureau in London and other cities in Europe. In addition, Pan American, British Overseas Airways, and others. Many airlines, TWA has been covering European cities with a "road show" of exhibits located at travel agents, hotel operators and officials and other agencies of the industry. Officials are now being featured American specialists. American introduces its "Visit USA" travel making contact in which the transportation to and from the U.S. is included. The airline has published an expanded American travel guide for foreign tourists, showing how to find accommodations and package brochures covering new package tours have been developed in sales offices in Europe and other languages.

• British Overseas Airways Corp. recently completed its second special group tour of Europe with program to travel agents, commercial representatives and diplomatic and consular officials. Quadros looked for means to make a foreign exchange and reduce north subsidies. Quadros' interest is political as well as economic he seeks to make British airlines a national instrument in his administration of closer relations with Africa and Asia.

Among Brazilian aviation development in the offering.

Needed more and continuous positive view more knowledge of the country better facilities for tourism. BOAC also has published booklet promoting U.S. travel and listing package tour specialists, travel agencies and other groups.

• Scandinavian Airlines System has held a series of symposiums in Europe and Asia. The agency, according to Danmarks U.S. Airlines, a new company and hotel companies were among those who participated with SAS in the program. A marketing program in Europe was launched in connection with the program. SAS believes a 200% increase in travel to the U.S. is possible in the next four years. The airline also has made suggestions for the improvement.

## Brazilian Carriers Plan Merger; International Services Combined

Rio de Janeiro—Brazil's international carrier this month made a step closer to formation of a single enterprise. Agencias (AWM) May 15, p. 45) is agreed to the consolidation of services.

Changing the way to fly a commercial of Panair da Brasil has passed from Pan American World Airways to a Brazilian group headed by Paulo Roberto, former president of Panair. The "agreed" transfer Panair, Real, Vozes and Aerovias. The latter airline branch was Real's international division, but recently, with a Vozes plan, of half its rating card, came under management of Real and Vozes.

### Airlines' Aims

In announcing the agreement, the airlines said it provided for "unification, simplification and fusion of services" in order to make possible, in the near future, formation of a single company of private enterprise, to act as the instrument of Brazilian international aviation policy. The airlines are not so much a merger of Panair's overseas services with pan american to compete with airlines, principally South American Airlines and Aerovias, in the world market for flights on the South American continent.

The agreement was made under government prodding and encouragement. It had its beginnings five months ago when the new government made it clear its intention to make a national airline. Quadros looked for means to make a foreign exchange and reduce north subsidies. Quadros' interest is political as well as economic he seeks to make Brazilian airlines a national instrument in his administration of closer relations with Africa and Asia.

Among Brazilian aviation development in the offering.

most of reception facilities in the U.S. • Air France is promoting and distributing large quantities of brochures and materials to travel agents and to the post country U.S. travel agencies. Specific lines are listed in cooperation with U.S. hotel and sightseeing companies. The travel agent material refers out how travel to the U.S. should be sold, but also includes the required registration made and to both. The airline is convinced that strong educational efforts must be made in promoting U.S. travel.

The U.S. Commerce Department itself has received that domestic tourists in U.S. travel more actively to occur as much as it is the new government program gets under way.

## Brazilian Carriers Plan Merger; International Services Combined

New line passed recently by the senate stipulates that there be at least 50% ownership by Brazilian nationals of Brazilian airlines. This means Pan American will have to sell its shares in Brazilian lines from 30% to 20%, and will probably liquidate completely a marketable equity owned.

• Panair's Middle East routes will be moved from Beirut to Cairo to serve Quadros' plan for closer ties to Egypt. • Panair will expand its routes in Africa after signing of bilateral accords between Brazil and Ghana and other new African nations.

• Panair will fly to the West Coast of South America, and its routes will be extended from Tokyo to Rio de Janeiro in India, linking with Panair.

• Panair, Vozes, Real (which keeps its own routes to Buenos Aires) and Aerovias will consolidate again and maintain services, facilities, sales and interchange companies. Aerovias expects delivery of aircraft 1955, this may be Real's first, a new aircraft, Lockheed for purchase of three Lockheed 1040 Vozes and Panair are in the market for jets for their domestic lines.

The airlines are negotiating on whether the consolidation will result in saving up Brazil's foreign jet engine market for the Brazil.

Robb-Brown recently visited a jet engine repair facility at Sao Paulo and is expected to return 787-420 to the Sao Paulo office. The airline is expected to be equipped with Robb-Brown personnel.

Majority interest of Panair was taken over by a Brazilian group headed by Quadros, who left the Panair president in 1954. The group in 1954 purchased 42% of Panair stock, resulting in holding to 61%. Prior reportedly was about \$3.1 million.

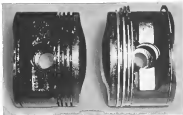
# BULLETIN:

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Left: Piston from engine using straight mineral oil after 1,000 hours, more sludge and wear. Right: Piston from new aircraft after 1,000 hours on AeroShell Oil W.

engine overhauls can be extended.

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## Trunkline Traffic Slump Eased in June

By E. L. Doty

Washington—Domestic trunkline airlines had an unusually quiet month in June, but in a slack traffic depression during the first seven months, even caused a slight improvement in June, but more airlines have felt that it is too early to determine whether the depressed trend has been reversed.

Final figures from all domestic trunk lines had not been received late last week. However, an AIRWAYS WEEK estimate placed the traffic increase for June at approximately 4% over the same month last year, but a substantial break from the slack traffic slump that began in May, 1960.

During the first six months of 1961, revenue passenger miles decreased 1.9% compared with the same period last year.

The first half of last year had shown a 7% increase in 1959.

In addition, the June increase is not sufficiently representative to indicate a new trend since actual comparisons figures are clouded by a strike that cut United operations at Houston Air Lines for an 11 day period during June, 1960. Because traffic has remained sluggish during a period when the general economy appears to be recovering at a relatively stable rate from the recent recession, airlines leaders are regarding the slump with alarm.

### Revenue Rise

During the first six months of 1961 the trunkline airlines will report a \$16,678,820 net loss, compared with a \$13,548,680 net loss for the first six months last year. Despite the traffic de-

cline operating revenues still show a 4.76% rise during this period.

Airlines had an unusually quiet explanation for the increase in revenues in the face of a traffic slump, although several officials felt that the rise in higher-yield long-haul traffic because of expanded frequent schedules plus last year's hotel and coach rates may account for the improvement.

Operating revenues climbed to \$167,922,080 during the six-month period, a 5.1% increase which accounts for the higher net loss. For May, the airlines will report a net loss of \$4.3 million, compared with \$2.6 million in May, 1960.

Coach traffic continued to show an increase while first-class traffic followed the depressed trend which began a year ago. The Big Four—domestic Eastern, United and TWA—reported a 5.9% increase in revenue passenger miles in June, but first-class traffic fell 13.5% while coach traffic rose 17%.

### Meager Factor

The Big Four results are not indicative of a trend since Capital Airlines traffic was absorbed by United Air Lines in June as a result of the merger between the two companies. United carried a total of 1,193,330 passengers last month, which the airlines dates is a monthly record. The carrier operated 791.2 million revenue passenger miles during June.

There is now no doubt that United will dominate the industry in the volume of passenger handled. Even before the merger United had taken first

place within the domestic industry, in the number of revenue passenger miles earned. The airline, as a regular operator of high-density coach seating, moved into first place in March, compared with third place the previous March, in the amount of coach revenue passenger miles handled.

Among the domestic trunklines, American increased the leading carrier in the cargo field as this fact has attracted more attention in passenger load by continued to drop. American's 11,777,000 ton miles which it claims is an industry record, represented a 14% increase over the same month of 1960 and topped United's June cargo business by 2.4 million ton miles.

### Summer Decline

Airlines last began watching the declining passenger volume actually in mid-December of 1960. In March, 1961, revenue passenger miles fell 1%, the first time a drop had occurred since the last weather month of January, 1960.

However, business rebounded in April, 1961, with an 18% increase, and the March decline was attributed to gains resulting in high aircraft market rates. During the next six months traffic leveled off to slight increases of an approximate 200,000, 5% increase with healthy monthly increases of more than 15% throughout 1961.

The drop in the business growth pattern was attributed to last year's recession.

The steady decline in traffic began in November, 1960, when the airlines reported a 3.7% dip in revenue, gain volume rates. In December, the decline



### Eastern 720 Transport Rolls Out of Boeing Plant

First of 15 Boeing 720 medium-long range jet transports scheduled for Eastern Air Lines is rolled out of Boeing Co.'s Everett, Wash., facility. Airlines will receive 12 of the new jet and the three plane delivery in 1962. Eastern plans to place three of the Pratt & Whitney JT7 powered planes in service this fall.



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## Viagra Receives First 880-M for South America

First Carrier 880-M takes off from Lindbergh Field in San Diego after acceptance by Viasa. Venezuela ordered another Viasa aircraft. Viasa will begin New York-Caracas service in August. Other cities to be served include Manaus, New Orleans, Bogotá and Lima.

was 4% and was 2.7% in January and 14.9% in February. Operations were suspended from February 17 to 23 in America, Eastern National TWA and United due to strikes.

In March the industry found some hope in a 5% rise in revenue, passenger miles. Although southern Northwest and Western had resumed full operations following the labor problems.

In April the demand trend returned and the industry suffered a 1.5% drop in revenue passenger miles. There was no improvement in May, when a 2.6% decline was reported, despite the

fact that all airlines had returned to size and operations.

A number of industry officials are emphasizing their position that even as carrier competition on major routes is causing serious financial damage to individual carriers, because capacity is completely out of line with traffic available. At the same time, each carrier is intensifying sales and promotional campaigns to lure available traffic away from its competitors.

The Civil Aeronautics Board has publicly announced that it will match the competitive picture closely, and it is highly possible that the forthcoming Northeast Airlines New York-Lima route, possibly a joint venture with the Board will go in across sending messages or taking steps to coordinate routes to correct the competitive picture. However, CAB Chairman Allen S. Bond has indicated that he will insist that airline management take immediate steps to explore new sources of opening new markets.

A long-term industry-wide marketing program may be in the making as a result of the current airline depression.

## U.S., Soviets to Begin Bilateral Negotiations

Washington—U. S. and Soviet will begin negotiations July 15 on a bilateral air transport agreement for regional air routes between Moscow and New York.

James M. Lindsay, special assistant to the President, will be chairman of the U. S. delegation and John D. Bolster, director of the State Department Office of Transport and Communications, will be vice chairman. As chairman of the

Civil Aeronautics Board beginning in 1945, Lindsay participated in negotiation of a number of bilateral agreements between the U. S. and other nations.

Col. Gen. Yuryan F. Lagutin, chief of Aeroflot, will be chairman of the Soviet group. Pan American World Airways, committed to operate the route, will be represented as observer status on the U. S. delegation.

Discussions will be scheduled for July 15 but may not be called off by the State Department on July 14 when Russia shut down an RB-47 on the Barents Sea on July 11.

## United Air Lines DC-8 Crashes at Denver

United Air Lines Douglas DC-8 turboprop transport crashed at Denver's Stapleton Field last night, during an approach landing, killing 16 of the 170 people aboard.

Surviving passengers and their crew, about 50 men, began leaving the aircraft in life-rafts during rain and functioning properly. The pilot, Capt. John F. Cassin, indicated Denver that the approach to land had appeared to be low but later reported it was adequate. The DC-8 apparently landed hard, spun off the runway, hit a narrow track parked at the edge of the airport and burst into flames as it stopped.

Civil Aeronautics Board immediately organized a five-day panel to launch an investigation. Fred L. Schuchman, chairman of the Board's Bureau of Safety and will include representatives from CAB, Federal Aviation Agency, United Air Lines and Douglas Aircraft Co., Inc.







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## Halaby Refuses to Restrict Southern

By David H. Hoffman

Washington — Federal Aviation Agency Administrator N. E. Halaby reacted to an agency investigation of 740 alleged flight violations filed against Southern Airlines, his repeated suggestion that the carrier's operating method is not cost-effective.

Halaby's stand thus immediately cuts down on Air Line 740s Air officials who last week accused the administrator of "booby-trapping" and staging a witch-hunt. Consequently, a group of aviation and industry organizations concerned with the 740s pilot strike strike against Southern were debating whether to press Halaby for confidential FAA reports stemming from the recent investigation.

Critics of Halaby's handling of the pilots' dispute were aware Southern pilots generally contend that the FAA's investigation report by comparison contains a significant contradiction. They feel that especially in view of Southern's reliance on federal subsidies, the number and seriousness of the violations actually occurred outnumbers a need for more drastic action than suspended pilot's license and fines.

ALFA spokesman beginning this week said Civil Aeronautics Administration's crackdown on Northeast Airlines in 1958 (AW Oct 27 1958) p. 18) after an aircraft inspection found that some Northeast pilots were having difficulty getting emergency landing details. "ALFA maintains that case would prosecution should be taken.

### These Alternatives

Raised legislative interest in the Southern strike could produce one of three results. From the most drastic point the most desirable would be the appointment of a presidential commission to investigate ALFA's contention that Southern has taken a reasonable position in achieving a settlement along with the flying safety violation charges. A second possibility was being studied in an independent investigation of the Southern situation by at least one congressional committee.

A third alternative that could result from legislative pressure was a Justice Department action whether Southern violated Southern 616 of the Aviation Act of 1958 by being uncooperative.

In a July 6 letter to a group of interested legislators—including Southern

A. S. Mike Morrison (D-Ga.), Warren Magnuson (D-Wash.) and Felix Kefauver (D-Tenn.) and Rep. Joe Brown (D-Tenn.)—Halaby summarized a legislative investigation of seven pilots employed by Southern since the strike began June 5 1960. The administrator disclosed that:

• Psychiatric treatment was received by three pilots previously employed by Southern. An emergency FAA license suspension immediately grounded these three. Examination by an FAA staff psychiatrist subsequently gave one a clean bill of health, according to Halaby. The other two were sent through a series of tests at Texas University, Austin, Tex., on June 27 the results of which will be analyzed by FAA.

• "Behavioral abnormality" displayed by one pilot no longer was Southern case, led to his hospitalization. Pending re-examination this pilot who has been grounded Southern pilot (AW June 12, p. 41) who has in top court in several cases of Southern pilots, DC-12, while holding only a private pilot's license, had his certificate revoked by FAA. His case will be referred to the Justice Department if FAA success claims of longer.

• FAA for the first time in its history, avoided a moth pilot's Arthur Tamm post ruling and his current medical certificate after learning that the pilot had served two prison sentences, including a federal prison sentence in 1954, while holding only a private pilot's license, had his certificate revoked by FAA. His case will be referred to the Justice Department if FAA success claims of longer.

Halaby said.

But all of these pilots, Halaby said

### Czech B-1B Crashes

General—Czechoslovak Airlines lost its second Soviet B-1B transport in the past two days and crashed on the ground while on its way to the airport. The crash was a high loss for the airline, which was approaching the end of its Soviet Airlines.

The crash which took the lives of all 71 people aboard, apparently had no connection with the loss of a C-54 117 near Garmisch on May 13 on the ground of the crash for several months last summer (AW Aug 26, p. 45).

CIA officials in Prague said the plane was on a routine over a Czech flight from Prague to Berlin. The crash was caused by a Czech pilot, who was killed. The crash was caused by a Czech pilot, who was killed. The crash was caused by a Czech pilot, who was killed.

crash was found by FAA inspectors to have the right qualifications required of pilots.

On approximately 270 allegations filed by ALFA, among them were Southern pilots of violating the Civil Air Regulations. Halaby said that call over 200 not aimed at pilots who allegedly committed numerous flight time violations. After a thorough investigation of each complaint each violation was measured by FAA, a violation found, minor and non-intentional by Halaby.

1 would be an alleged violation of other CAA regulations that in night violations the investigation was of violation magnitude. In current other action against the airlines because of a civil penalty. This included the operation of a DC-7 in scheduled service with its landing gear down and locked in place with such pass, the landing of a DC-7 at the wrong airport, a departure from Nashville Airport without a takeoff clearance, then continued operations in landings in between from neither and one instance in which a pilot closed to land on his destination airport's shortest runway, then ground-looped by aircraft to add a ditch at the runway's end.

Halaby concluded his report to the legislation by expressing doubt that Southern "severely" violated regulations and judgment in the civil cases, and asked "expansion of investigation" in the violation of applicants. "The subject," he said, "is under continuing investigation in this agency pending completion of our report."

But Halaby also reported that Southern apparently was complying with appropriate regulations and that "no action against the certificate of Southern is required in the public interest." It appeared certain that such that at least one congressman, Rep. Robert W. Humphrey (D-S. C.), would ask Halaby to launch the new national law which the Southern investigation report is complete in House, Rep. Humphrey, World War II bomber pilot, said it clear that he could not judge in the adequacy of the FAA investigation until the information had been received and digested.

ALFA is convinced that it cannot afford to accept the situation that Southern is without recent widespread safety as a union. It is aware that the success of Southern management serves as a model in the industry to other airlines. ALFA is not convinced and that such airlines could lead to further loss of the future.

At the same time ALFA is concerned that the International Brotherhood



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load of Transcon could give its first foothold among airline pilots in organizing the nonunion employees at Southern.

Meanwhile, Southern reports that in June it carried a total of 36,619 passengers, a record for any month's operation.

The reported an 8% increase over the airline's May business, when Southern bonded 32,884 passengers. With the addition of Manchester, Texas, and Pascagoula, Miss., on July 1, Southern now stands 61 states in its northeastern routes.

## Strike Forces BOAC To Charter Aircraft

**London**—Unofficial strike by about 400 British Overseas Airways Corp. crew planes at London Airport last week forced the airline to charter equipment for transatlantic passenger connections at Prestwick, Scotland.

The strike, such as deterioration in the Bristol Britanni large, about 100 miles from the de Havilland Comet instrument ship and others from propeller and thrust engine engine ships. At least a new BOAC supervisor will not in which business and inspection jobs have been merged into a single supervisory job.

BOAC chartered two Victorias, one from British United Airways and the other from Tyneside, and a Britanni from Coastal Eagle Airways, with whom it will be competing on the North Atlantic next year.

About 200 passengers were transferred to Prestwick, Scotland, to meet connecting flights to New York, Geneva and Montreal.

As of midweek, three Britanni flights had been cancelled because of the strike, one between to Bengal and two between Los Angeles and Montreal.

The company said the supervisor was in the last phase of a planned reorganization of the engineering department to reduce costs. In a letter to strikers, Charles Abell, chief engineer cited a day in BOAC business and a vote of competition making.

It is the time to damage BOAC when we are preparing our appeal against the Air Transport Licensing Board's decision to license another operator on the North Atlantic."

Meanwhile, BOAC has completed Xmas of its 31 Britanni. Ending five airplanes with crashes in the last large incident (AW July 10 p. 16). Bristol Aircraft the manufacturer and Xmas of the company is a transition for all operations, including British Air Force and Royal Canadian Air Force. The 8% is not independent. Not the company and a design modification may be made.

## U.S. Recession Called Main Cause For Slump in Transatlantic Traffic

**New York**—U.S. recession has been the single major cause of the slump in transatlantic air traffic in the summer of KLM's new 45-year-old president.

E. H. van der Bregel, who took the top KLM post June 1, said the slump was an unexpected problem for the carrier in a year when all other airlines had been concentrated by the technical and financial difficulties of transatlantic to get started. Whereas they had planned for several North Atlantic growth, traffic early has not materialized in the first month but has actually declined, "which means we are much."

But, having a pure political crisis over Berlin, the trend also change, van der Bregel said. Long-range prospects are good, van der Bregel said last week at a conference here.

The KLM official discounted other theories as to the reason for the slump in transatlantic traffic, such as political problems concerning the U.S. balance of payments. He said the recession there is not enough to the U.S. domestic traffic decline, which he said almost exactly parallels the transatlantic traffic trend.

KLM's own prospects for 1961 are uncertain, van der Bregel said. Reduction of the Dutch profits this year was a record, van der Bregel said, the airline losing in an approximate 5% loss of revenue (AW May 29, p. 42).

The new KLM president, who in 1957 as The Netherlands deputy minister of foreign affairs headed the Dutch delegation that negotiated the bilateral agreement with the U.S., could not comment on recent attacks by Pan Am and TWA. Negotiations are going on in Washington, he pointed out. But he said it was unusual that airlines, the most modern of commercial transportation companies, should be based on bilateral procedures in a world that since 1946 has grown to sophisticated delays in negotiating or economic action.

Regarding the "Visit USA" program currently receiving considerable attention, van der Bregel said attracting European tourists to the coast is a long-term goal at KLM in the next few years. It is self-evident he said that with the increase in Europe's standard of living there will be a vast increase in tourism to the U.S.

Holland might prosper, he said, as members of European nations to the country despite its 12 million people.

being, and KLM has been a leader in the field of promoting such traffic in Europe.

But there are "a few difficulties" in the "Visit USA" efforts. This is still an open economy, van der Bregel said. Another problem is what to do with the hotel and New York. Van der Bregel said that a significant obstacle in the past, but there has been a definite improvement in the past few months. In general, the U.S. is among the best places for tourists in the world, but people haven't the financial idea of what to do with tourists."

Other points touched on by the KLM president:

The 17% off season discount fare has drawn passengers from that class, but its purpose was not to boost first class but overall traffic and this has been accomplished.

Transatlantic bankrupts last three of KLM's Douglas DC-8s in order to save 50%.

Flight gone volume will have to increase 20% and September, when lower rates go into effect on the Atlantic, to keep revenues at their present level.

## Engineers Will Fly Berlin Runs In Strike

**Washington**—Flight Engineers International, Van told President Kennedy last week that its members would refuse to work on Pan American World Airways aircraft flying to Berlin if the union demand strike on the airline's other routes.

FEA is dissatisfied with Pan Am's plan in a dispute over recommendations from the Foreigners Commission last May that the union merge with Air Line Pilots Assn. and that tailcoat over the limited to these men all jobs merged (AW July 1, p. 18). Deadline for the final "cooling off" period is July 10.

Pan Am's aircraft 20-70 flights a day into Berlin from Frankfurt and Hamburg, mostly carrying light cargo as part of the InterContinental Service Agreement.

FEA wants to assure the President that national security in Berlin could not be endangered in the event of a strike.

In another labor development, Western Air Lines mechanics (and 250-300) to withdraw from the International Assn. of Machinists and to join the Technicians.

## AIRLINE OBSERVER

Department of Commerce study group is taking a third look, in national transportation gain benefits of this study, which will take advantage of Projects Hutton and Bessie research will be forwarded to Commerce Secretary Luther Hedges who intends to implement a Hutton Commission recommendations calling for a reduced U.S. transportation policy. The law was first first, organized by William Dean of Secretary's Institution, is coordinating various aspects of the Commerce study with Federal Aviation Agency Administrator N. E. Harts.

Sud Aviation is seeking government approval to increase its Conquest production program to 250 aircraft. Presently, the Conquest program is based on a total production of 150 aircraft which will cost over \$16 million. 25 options, it is about considered. Sud officials say that 250 aircraft represent a reasonable estimate of Conquest market possibilities. Breakdown point is 225.

Allegiance Airlines is taking first steps to dispose of its fleet of eight Douglas DC-7s. The airline will operate all its services with a fleet of 29 aircraft including five Conquest 540 turboprop transports, eight Conquest 480 turboprops and 16 Martin 202 and 203A turboprops. Earlier this month Allegiance purchased four Martin 202As from TWA.

Answering Whitehead will send a team to the U.S. to conduct studies on Answer turboprop cargo transports delivered to Middle Airline Modification are to convert six units to be used as medium-range and medium-range of the line-hauling market. Cargo has three units delivered and will receive remaining four, which have been built and modified this month and in August. Two of the aircraft are in flight operations at an average of 80 in utilization. In September Middle plans a 15th utilization for each aircraft in flight to meet contract schedules.

Clarence N. Soren, president of Air Line Pilot's Ass., was scheduled to arrive back for a week to two weeks stay in the Soviet Union despite protests filed by the AILCPO executive committee which disapproves work trips by U.S. union leaders. Soren was going in the guest of the Soviet civil pilots organization in his capacity as president of the International Federation of Air Line Pilots Association. APLA's own executive committee was not consulted.

British Airways is seeking Civil Aeronautics Board approval to sell three Douglas DC-4s and 15 Pratt & Whitney R-2800 engines to British United Airways. Plans are to be delivered no later than July 11.

Commercial Airlines and TWA have been granted a 2,000 lb. fuel tank for use on aircraft ordered by the Federal Aviation Agency for the Pratt & Whitney JT-3C turboprop engine which powers the new carrier Boeing 707. It is the first time a U.S. designed and manufactured turboprop has reached the 2,000 lb. standard for aircraft.

Local service airline industry will report record traffic gains in June.

Russian East European airlines are still going to abroad lengths to reach local air traffic on commercial airline traffic. During Russia's recent Airline Day, meeting the first anniversary of the first flight by a Russian pilot, the government proudly revealed that "during the first five months of 1961 the volume of air traffic was 75 times greater than in all of 1953."

Only hours selling of Eastern Air Lines stock is officers during April and May doesn't accurately reflect their attitudes on the company's outlook. Many Eastern officers borrowed extensively from banks since Eastern's stock option plan went into effect, and their loans fell due at a time when the stock price had fallen.

## SHORTLINES

Eastern Air Lines will build a \$17 million hangar and maintenance facility in Atlanta Airport to be completed by 1963. The hangar will house three Boeing 727 jet aircraft or two 727's and one larger transport such as a Douglas DC-8.

East Coast Flying Service has been awarded its 5501325 Military Air Transport Service contract to haul passengers and cargo in the southeastern U.S. for National Aeronautics and Space Administration.

Federal Aviation Agency has awarded the Benthon Co. a \$11.6-million contract for 48 indoor lighted doghouses to be installed in LAA air route traffic control centers.

International Air Transport Ass. is partly from African airlines—Air Guinea of Republic of Guinea and Air Mali Republic of Mali—and no Argentina, Colombia—Juan Antonio Argueta—no new members.

New York Airways reports one of its Boeing 707-44 helicopters has flown more than 5,000 hr. during the last three years.

Pacific Air Lines will offer \$1.5 million to \$1.5 million in new aircraft delivery contracts and 100,000 shares of common stock for sale in August. The proceeds will be used primarily to pay debts in current loans having new aircraft and cargo.

Sabena Belgium Airlines has ordered two more Sud-Mat VI Conquest jet transports bringing its order to a total of eight.

San Francisco & Oakland Helicopter Airlines reports it carried 351,000 passengers on June 10, one month after it began operations in the San Francisco area.

Sylvania Analysis and Research Corp. has been awarded by two former members of United Research Corp. Nathan S. Smith, president of the new organization and Sam I. Aldrich, vice president. Glenn E. Smith, former research assistant for the Air Transport Ass., also has joined the company.

Trans World Airlines will begin showing movies July 19 in the first-class section of aircraft on transcontinental flights. Eighty-eight movies will be shown in Minneapolis and West Coast/Chicago pilot flights after Aug. 14.



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The truly astonishing built-in potential of the Olympus has been confirmed by the threshold increase in power from the 11,000 lb thrust dry of the original production engine, to the 35,000 lb thrust with release of the bleed nozzles.



Olympus ready for test with bleed air system

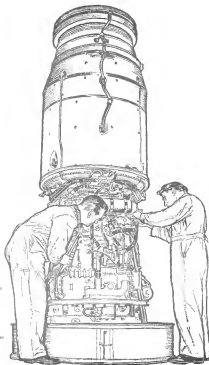
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AP25V	3.8	8.5	4000	1500	1000
AP30V	2	8.5	4000	1500	1000
AP35V	3	1.9	1000	1500	1000
AP40V	3.6	1.6	1500	1000	1000

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## MISSILE ENGINEERING

### Thrust of Blue Streak Engine Increased

By Herbert J. Coleman

London—Rolls Royce RZ.2 rocket engine, for the British Blue Streak launch vehicle, has reached thrust velocities of 150,000 ft per sec and can be increased 10% with relatively minor modifications, says Rolls Royce engineer and boss.

A V. Cleaver, Rolls chief rocket engine manager, told the European Space Conference on Space Technology that tests have shown the RZ.2 engine can run stably down to about 50% thrust and still achieve lower loads through modification of the thrust chamber injection system.

If required, Cleaver said, a third fuel source of the engine, which would provide controlled thrust, could be built. At present, running reliability is 96% and starting reliability is 92%. In testing the RZ.2 in several configurations (disrupted RZ.12), starting reliability has been 95% and running has been 100%. Better performance was due to under coupling and more reliable engines in the program progressed.

These last tests, he said, of the power engines, compared with 117 for the RZ.2. Starting has been a major problem. For instance, out of 474 starting attempts on the RZ.2 only 365 were successful. A good number of these failures, Cleaver said, were due to problems in the jet system, especially in the early days of operation.

Both RZ.2 and RZ.12 have made eight runs of 150 sec duration or more (total test runs have been 3773 sec for the RZ.2 and 2,532 sec for the RZ.12). Tests are carried out at Spaceport Central (ASW Sept. 19, 1960 p. 116).

Some of the failures outlined by Cleaver were:

- Liquid oxygen pump explosion fitted to a different race fitting. Design has been altered and tested successfully on a turbo-pump.
- Snow start during one test blew the thrust chamber out. Cause unknown, due to a fuel leak.
- Thrust chamber and injection nozzle fastening techniques were found to be correct in proving a good mating. But Rolls feels this problem has been overcome.

Cleaver said flight engines now are being delivered to within 1% of the specification limit, with a further 1% margin built in for test margin.

The RZ.2 engine was developed and adapted by Rolls-Royce from the Rocketdyne R-33 which, when used,



Bottom of propulsion has shown key in RZ.12 paired configuration, is fitted with test stand. These engines are installed in extension of two turbine shafts to provide gas for pressurizing vehicle propellant tanks.

with minor variations in the Thor and Jupiter intermediate range ballistic missiles, and in Atlas booster stages. Fastest engine on the Blue Streak program was an RZ.1 which is a copy of the RZ.2 of which six were built for testing while RZ.2 was on the bench.

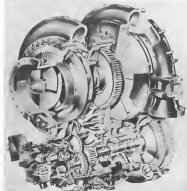
The complete RZ.2 engine weighs 1,500 lb. Propellants are liquid oxygen and kerosene which provide a specific impulse of 289 sec at cutoff at about 250,000 ft. This works out to about 160 sec of powered flight.

In the powered version of Blue Streak, each engine has a turbo-pump act which feeds propellant to the thrust chamber. The chamber is reciprocally cooled using the wall of its tubular construction, total flow of kerosene from two

chamber rolls before entering the combustion chamber. Propellant pumps are driven by a turbine, which is supplied from the specific gas generator burning a very rich mixture of propellants.

In the RZ.12 paired version, the two RZ.2 engine thrust chambers are mounted directly under the main structural member of the propellant tank. Turbopumps are mounted to one side of the chamber. Each thrust chamber has gaseous bearing blocks at the attachment points to permit tilting through about 7 deg. in two planes at right angles. Cleaver said this system provides vehicle yaw, pitch and roll control without any need for separate control valves.

It is used for the thrust chamber



**TURBOPUMP** is turbine which drives, through a 400:1 two-stage spur ratio fan gear, the two propellant pump impellers which are mounted on a common shaft.

movement, high-pressure feed lines from the turbopumps incorporate flexible sections. The bottom of the tank has a heat shield to protect against over-temperature heating in the event of an explosion of chamber or turbine exhaust gases. Heat exchangers to preheat gases for tank conditioning were designed by de Havilland, along with automatic jacks for jacking the chamber.

Ignition sequence is governed by an electro-pneumatic control system. This initial sequencing is automatically controlled from a ground relay, but is initiated by passing the "start" button. Valves are actuated by pneumatic slave pressure regulated to 750 psi and taken from high-pressure bottle tanks mounted on the vehicle.

#### Starting Sequence

The thrust starting sequence, which shuts down automatically if not in progress, is as follows:

- Start signal initiates pressurization of gaseous start tanks and lubricating oil tanks.
- Firing of thrust chamber igniter is initiated.
- Electrical lock in thrust chamber igniter burns through and opening of main liquid oxygen valve and fuel igniter

valve is initiated. Liquid oxygen enters start tank passageway, enters the thrust chamber and its igniter.

• Liquid oxygen valve flow is established which breaks ignition detector seal stretched across the thrust chamber exit. Breaking this seal initiates the main stage by firing the gas generator igniter, both in these systems burn through and equal main fuel valves to open.

• Opening of fuel valves initiates opening of the gas generator block valve, thus supplying hot gas to the turbine which accelerates pumps and begins to feed propellant at high pressure to the thrust chamber and gas generator.

• Fill-backcheck valves at exit from start tanks close and start tanks are vented when pump output pressure exceeds start tank pressure. Engine is now self-energizing and start sequence has been completed.

Automatic cutoff can occur during the ground run at certain "rollback" parameters are exceeded, such as thrust speed and liquid oxygen pump bearing temperature. A combustion shutoff device can stop the engine if more than a preset number of vibrations occur within a specified period.

Cutover and the time from cutover

## ADVENT



To create a worldwide communications system, these ADVENT satellites could be spaced equidistantly in an equatorial orbit. Each satellite, orbiting at 7000 mph, could hover in a constant position relative to the Earth, in direct line of sight of approximately one third of its surface. ADVENT is being developed by at least one pair of satellites in orbit: operation General Electric's Missile and Space Vehicle Department is developing and building the ADVENT space craft and the following subsystems:

**Tracking and Command** to provide position and orbit information.

**Propulsion** to reject the ADVENT satellite into its correct orbit.

**Power** to operate the communications and all other equipment—from solar energy harnessed by several thousand solar power cells, and from storage batteries for operation during eclipse.

**Attitude Control** to orient ADVENT's solar cell panels toward the sun and its antennas toward the Earth.

**Environmental Control** to keep equipment operating at the stable temperature necessary to fulfill the long-life requirements. Telemetry to provide continuous transmission of data on equipment performance.

MSVD, a Department of the General Electric Defense Electronics Division, is developing the space craft for the U.S. Army ADVENT Program under a contract with the USARF Space Systems Division.

100-10

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start to fill (most taken about 4 sec) and average thrust buildup rate from 191% to 94% (rated thrust is about 0.7 x 10<sup>6</sup> lb./sec. Minimum rate is about 2.25 x 10<sup>6</sup> lb./sec. Average rate of thrust decay from 94% to 10% is about 0.4 x 10<sup>6</sup> lb./sec. and minimum rate is 1.4 x 10<sup>6</sup> lb./sec.

Blue Streak can be shut down in flight by a signal from the vehicle control system.

Gas generator valve and liquid oxygen valve close about 100 milliseconds after the main fuel valve. Clever and this fuel rich cutoff gives more repeatable thrust decay and reduces residual impulse.

Main fuel valve and main liquid oxygen valve are of the butterfly type, in which the flap is actuated by a pneumatically operated piston.

Actuator on the liquid oxygen valve has a heater to prevent freezing and sticking.

#### Injector Assembly

Injector assembly consists of a union of concentric injection rings which are welded into the stainless steel injector plate. Rings are sealed in assembly grooves (shaded in the line of the plate) prior to burning, the thin separator between the grooves are rolled over onto the rings, providing additional retention.

Starting with the outer fuel ring, alternate rings inject liquid oxygen and fuel.

Fuel emerging from return tubes of the thrust divider enters the injector via a series of side ports and then, via smaller grooves and drillings, flows to the injection rings. Liquid oxygen enters at the back face of the injector. Using this construction, metal seal rings are precluded from the afterburner injection, eliminating the use of rubber rings.

Roll-Royce has checked injector two independently with thrust paint—surrounding up to 4500 lb. but the test liquid exact is not certain because some of the paint failed away. Clever noted that it is believed that combustion is 93% complete about 1 in. downstream from the injector.

#### Japanese Self-Defense Command Revamped

Tokyo—Japanese government and Self-Defense Agency have abandoned hope for funds from the peace pact pact for the study of a helicopter air craft carrier and organizations in the present air defense warning system. Two new laws have been passed, however, reorganizing the command organization of the Self-Defense Agency.

The command organization now is similar to the U. S. system of joint chiefs

Previously, each of the three units of the Self-Defense Agency—the Ground, Air and Naval branches—reported directly to a unified commandment who was responsible in turn to the politically appointed minister of the agency.

New, a chairman of the joint staff would command all the forces as an advisory, subject to the approval of the minister of the agency. Naval air forces were transferred to the command of the chief of staff for naval forces.

Authorized strength of the armed forces was increased by 10,000 to a total of 280,000.

Lack of funds for the studies never

that the Japanese early warning system will remain as it is now, a basic survival system.

The ratio of expenditures in the budget for Fiscal 1963 has been changed slightly in favor of material, but personnel expenses still take 63% of the total armed forces budget of \$500 million.

In addition to the budget, Japanese forces will receive \$50 million from the United States, \$25 million of which will go to the Lockheed F-104J program. The Japanese Self-Defense Air Forces will receive three F-104J this fall and hope to have a squadron operational by the summer of 1962.

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## New Technique May Detect Nuclear Blasts

Washington—Use of underground radio waves generated by an underground nuclear explosion may permit detection of clandestine nuclear blasts which would be difficult to spot by present seismic methods or to distinguish from natural phenomena such as earthquakes, Radiation's Clark C. Aht told the recent Ashton Electronics Convention here.

This could open the way to an extra-ordinary detection system which would be virtually foolproof both to the U.S. and the Soviet Union.

Network of 3,000 small extended antennas in key areas of the globe equipped with both electromagnetic and seismic sensors, may be able to draw into view of the first alarm produced by nuclear events, reducing the number of international on-site inspectors required to investigate suspicious events. This has been a major stumbling block to an anti-nuclear nuclear test ban agreement at Geneva.

Nuclear explosions above the ground are known to produce radio waves because of the sudden expansion of air surrounding the blast, a principle exploited in Defense Department's first anti-Madrid detection system. They suggest that underground radio waves also will be generated by buried nuclear tests, but this has not been confirmed by tests.

### Seismic Decoupling Problem

The principle of seismic decoupling has proved a serious obstacle in an earlier test ban agreement. The seismic disturbance produced by an underground explosion can be reduced by

using a large amount of water or oil in the proper size and shape in a variable medium. This decoupling principle was partially confirmed in the Soviet tests of high-yield nuclear tests in Nevada and in the Soviet Union tests in a more, still medium, a soft mass in Leningrad.

By reducing the seismic disturbance by a factor of 100, decoupling makes it far more difficult to detect an underground nuclear explosion in the presence of earthquakes and similar natural events, except by means of an exceptionally large number of detection stations and/or by using seismic responses, which the Soviet Union opposes.

An American feature of the combined non-electromagnetic/seismic detection system described by Aht is that decoupling is not expected to reduce the

strength of the radio waves produced by the nuclear explosion. Scientists theorize that the decoupling which reduces seismic decoupling, possible may actually increase the strength of the underground radio signal generated. And because underground radio waves are not produced by earthquakes, chemical explosions or lightning, they can provide a unique characteristic which permits identification as underground nuclear explosion, Aht said.

Radiation and Alfred Research Associates, Inc., jointly conducted an investigation and study of a nuclear test ion expansion system, using computer loads. The investigation included tests of propagation of deep state underground radio waves, with results which indicate that very satisfactory signals can be obtained at frequencies below 10 kc.

Aht described an Automatic Test Detection Detection Inspection Team which would operate in the Soviet Union, which would be prepared to use electromagnetic sensors with sea wave detectors. Although the number of stations required for a global monitoring system depends on the desired resolution of possible detection and identifying decoupled underground nuclear tests and on the minimum size of detection to be detected. Aht estimated that about 3,000 stations could provide a reasonable level of assurance.

He pegged the initial cost of such a system at around \$15 billion with annual operating costs, including site visits, of about \$1 billion.

Each of the main Anti-Madrid stations, weighing an estimated 1,000 to 2,000 lb, would be designed as a self-contained package, including electromagnetic and seismic sensors, signals and data processing equipment, radio communications equipment, temperature, alarm circuits and electric power supply.

Because many of the stations may be situated in remote areas, they would be constructed as radio-transmittable or air-transportable units which would require a minimum of maintenance other than power might be supplied by solar cells or wind-driven generators. However, a station also would have an emergency battery supply which would enable it to broadcast an alarm in the event someone accidentally or intentionally blocked its main source of electric power.

To hold down the amount of electric power required by an Anti-Madrid station, Aht proposed to minimize the amount

of information which it must transmit to close much of the signal output of the site. Thus the station would transmit an alarm only when it had received both seismic and electromagnetic data whose correlation suggested a clandestine nuclear explosion in the vicinity.

Otherwise the risk transmission from risk of the Anti-Madrid station would be a possible "off" signal to indicate that the station is still operational.

### Spacing Factors

Geographic spacing between individual stations would depend on many operational and political factors—for example, the availability of the terrain for decoupled underground nuclear tests, the desired probability of being able to detect an underground blast in the desired medium size, the radio frequency and the location of a suspicious event can be pinpointed, and the reliability of individual stations. Another important factor related to probability of detection is the accept table rate of false alarms, which would require usually investigation.

Present studies suggest that between five and 10 stations within zones and electromagnetic wave range of one another, the detection of a nuclear test would be needed to provide a high probability of detection with low probability of false alarm, and to accurately pinpoint suspicious event locations, Aht said.

Because of electric power supply limitations, the Radiation-Allied test station study suggests that each station must also be used as a radio relay for communicating with an Anti-Madrid control station and that attempting to make each station to communicate directly over several thousand miles.

However, the network would be such that copies of one or two stations would not produce major gaps in system coverage. As proposed to use a "chain network" in which one station can serve as an intermediate relay for others in the vicinity. This means that all stations must operate at the same radio frequency and with the same coding so that any one can serve as a relay for another station in the network, but without mutual interference. Aht said that Radiation recently has developed a one-way link system which permits chain station propagation without interference.

It uses low frequency ground-wave propagation for beyond line-of-sight



Chrysler Vought Aerospace Division has initiated a plant checkout procedure for the Scout launch vehicle. Vought performs all system checks at its Dallas plant, rather than at the launch pad at Wallops Island, Va., as was previously done.

## Vought Uses Plant Checkout for Scout



Electrical engineers (above) check ignition and detector system in Vought Aerospace Scout checkout. Procedure also includes measurement of control and guidance packages (below, left) and installation of wing barriers on test and ground stages (below, right).





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range and a cost reduction, cooling system. The new cooling station transfers coolant transmission in a reactor so that the output again except only a fraction of the required transmission loss. If the output information from each station is sampled at the head of the transmission data rate, all data streams can specify on the same frequency without interference, he said.

The cooling technique and the product transmittable security against accidental or intentional jamming would go to ARI.

Ari does not minimize the problems of providing an ARI station from long, unimpeded lines of sight, often conducted in mountainous areas, or from the aspect presented at the Mission Electronics Conference dealt with possible countermeasures and means required to combat them. However, the fact that the proposed system employs both science and electronic aids detection, with cross correlation of the two, makes the system considerably more difficult to fool than one using only sensor detection, he believes.

For example, it has been suggested that detection of a number of conventional explosives suitable spaced in both time and geographical location, could be used to reveal an undetected explosive explosion in its location. But this technique, ARI believes, would not be effective against ARI because the chemical explosives do not generate electromagnetic waves. ARI also apparently detecting a disturbance, or change that at a time of high centrifugal disturbance, also would be considered for the same reason.

Ari contends that it might be possible to reduce the expected disturbance when more is detected, the undetected ground site with a signal or carbon lining. However, this would result in some of the most of disturbance and might produce the opposite result of reducing the seismic damping effect.

#### Audit Alarm

A more direct approach to doubling the ARI station would be to put a number of its stations out of action in the vicinity of the intended clandestine explosion. However, each station would be equipped with an alarm clock would be triggered whenever incoming, tried to enter or otherwise tampered with the station. If a large number of stations occur outdoors to be detected out of contact before the alarm sounds, the gathering mass of alarm stations would still alarm suspicion and call for an active inspection team investigation.

A more indirect approach for a test true violation would be to use signals from the ARI stations in the vicinity of the clandestine explosion. However,

this jamming would be immediately apparent to the ARI control center and would itself suggest the location of the violation. Another possibility is for a violator to build portable ARI station transmission and send out false signals, repeating during the cycle rate, but this would not deny the ARI headquarters access to the real station transmission which would be releasing a probable violation.

As Ari sees it, the ARI station designs need only ensure that an active countermeasure is positively identified as such and not as a natural occurrence. Unless a counter were positive that it could detect or find the ARI system without being detected, it would not be likely to run the risk, Ari believes. What action should be taken if such intentional countermeasures is detected is a question that Ari leaves to others.

If agreement could be reached now to proceed with such a system, Ari estimates that it could be in production by 1967 and ready for deployment the following year. Ari is a manager of personnel, materials, and facilities in the Mission and Space Division, Bedford, Mass.



#### Boilerplate Atlas F

The Atlas F, fitted with 25,000 gal. of water, is being used at Vandenberg AFB, Calif., to test the electrical and search platform drive effectiveness of the one launcher platform. Platform drive is being checked for device maintenance, electrical under loading and its possibilities. The 50 ft. high, 104 ft. diameter drill app simulates the dimensions and, when fully loaded, the weight of the F-400 missile. Doubtless the weight also simulates weathering might distribution of windload. Operational Atlas F's, stored in 17 ft. deep silos, will be used to conduct before firing.



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Black Brant IV: two-stage, Canadair-developed, research rocket; will separate and each stage become a one-stage vehicle (Black Brant V and VB). The first stage successfully static fired in 1979, develops 20,000 lb. thrust for 29 sec.

## Canada Tests Black Brant Missile; Seeks Defense, NASA Interest

Canadian Aircraft Research and Development Establishment (CARDÉ) and Bristol Aero-Industries Ltd. are developing a family of three Black Brant research rockets able to carry scientific payloads of 20,210 lb. to altitudes up to 500 mi. Canada is attempting to interest the National Aeronautics and Space Administration and the U.S. Defense Department in the all-rocket system as part of the bilateral defense production sharing program. First development flights next test vehicles called Black Brant I and II (below and right) to test stability, payload configurations and motion in launches from F4 Chevrons. Black Brant IV (top) is a model of the two-stage system. Two single-stage versions also are planned, each using a stage of the Black Brant IV. The Black Brant research program began in 1967 with the launch of 18 test rockets to check propulsion systems and the first stage of Black Brant IV was first static fired in 1979. It developed 20,000 lb. thrust during its 29 sec. burning cycle. CARDÉ plans to launch full scale prototypes of the three Black Brants next year. Nine major test fires are scheduled by Canadian, Ltd., and Bristol Aero-Industries through the winter months. Highlight of development flights to date occurred last fall when a cloud of nitro oxide was released from a Black Brant I nose cone 60 mi. above Ft. Chiswell to assess the effects on oxygen atoms of the rocket's passage through the atmosphere. Additional upper atmosphere experiments are planned this year.



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Photo below shows nose cap of missile in space exploration program at a test run of nose cap material (approximately 2000° F.)



Photo of nose cap of missile in space exploration program.



Photo of nose cap of missile in space exploration program.



Photo of nose cap of missile in space exploration program.



Photo of nose cap of missile in space exploration program.

## AVIONICS



**NEW BLIND-LANDING SYSTEM**, called Flareout Instrument Landing System (FILS), with a precise flareout reference to landing ILS performance. New system developed by AIL Division of Cofair-Hawker, is shown under test using a B-25 aircraft of MacArthur Field, N. Y., prior to delivery of a system to Federal Aviation Agency for evaluation at its Atlantic City facility.

## FAA to Test Flareout Guidance System

By Philip J. Klaus

MacArthur Field, N. Y.—New all weather landing system, designed to replace present ILS beams, will be delivered this month to Federal Aviation Agency's National Aviation Facilities Experimental Center at Atlantic City, N. J., for flight evaluation this fall.

The new Flareout Instrument Landing System (FILS) was developed by Avionics Instruments Laboratory, Dear Park, N. Y., now known as the AIL Division of Cofair-Hawker, Inc. FILS is a ground-based system that produces an extremely large number of precise, microwave beams which radiate from the runway and intersect the existing ILS glide slope beam. The system permits transition from glide slope to flareout at any desired altitude and provides a wide range of possible flareout paths. FILS also can be used to provide steep angle approaches for helicopters.

The only new airborne equipment required is a microwave receiver-collimator. Present AIL estimates indicate that the airborne unit would weigh less than 70 lb., or less than 40 lb. in a dual version.

The FILS system, demonstrated to Avionics White House at MacArthur Field on Long Island, N. Y., is an outgrowth of AIL's work on a completely new instrument approach and landing

system originally conceived as a potential replacement for existing ILS. AIL started its work in 1955, with company funds.

The original system was called EAGLE, an acronym for Electronic

Angle Guidance Landing Equipment. A few months ago AIL altered its approach after its studies indicated that the basic investment in ILS ground and airborne equipment used the world made it unlikely that this



**FLAREOUT** antenna moves through a 40-deg. vertical sweep, transmitting pulses whose repetition rate (optimal) is proportional to antenna's elevation angle. This picture shows antenna motion by series of multiple exposures. FILS transmitters operate at 14,000 mc.



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a combine that does not exist at many altitudes, or else the aircraft must descend to the minimum altitude it is over the runway, thus losing use of a portion of the runway for landing. With FELS, an aircraft can determine its altitude, forecast turbulence point and forecast with regard to instrument failure.

• **Pre-flight check:** Because the FELS beams extend out for distances of up to 20 mi., the pilot can check portions area of his airborne receiver and the ground station long before he reaches point of starting descent maneuvers at low altitudes. This can be done by measuring the relative angle of the regular FELS glide beam and one of the FELS beams in the upper planes over the outer marker beacon, or outer edge of the approach and airport are equipped with distance measuring equipment.

### Improvements Needed

Enhanced modes that effective use of FELS can require improvements in some low-altitude operation existing glide slope conditions. To achieve desired accuracy, the FELS antenna needs to be located approximately 3,500 ft beyond the glide slope antenna. At airports where the terrain immediately preceding the runway is not smooth, a circumstantial glide slope antenna must be located back some distance along the runway, which makes the FELS touch-down point correspondingly further down the runway—a disadvantage for airports with short runways.

However, a recently developed wave-type antenna which does not require ground reflected energy to position the glide slope beam can therefore be independent of airport's terrain and be used and maintained at the start of the runway. A detailed note of this antenna is being prepared.

The new AIL station operates in the microwave band at a frequency of 15,900 mc to give the precision beam required for descent. The vertical sensor antenna is a modified gulfon type that generates a fan-shaped beam in azimuth which is flat in the vertical plane having a thickness of 1 deg.

As the FELS antenna scans vertically, it sweeps a series of pulses which automatically are coded to indicate the antenna's elevation angle at any instant. The coding takes the form of varying the pulse repetition rate and duration of the base square between its divided pulses. This, in effect, produces the same individual FELS beams, each with its electronic identification.

As the antenna's beam sweeps past an airplane's main instrument antenna, the electronic receiver need only measure the spacing between individual pulses to determine which of the FELS beams it has intercepted. In this respect AIL's system resembles Cadillac's RSCAL. However, the latter uses an additional airborne transponder which intercepts

the ground transmitter to measure aircraft distance from the ground station, the master of DME. The Giffen system uses angle and distance information to establish aircraft position whereas the AIL system uses the angles formed by the intersection of the FELS glide slope and the FELS beams.

The spacing between individual pulses in the AIL antenna ranges from 15 microseconds at zero degrees azimuth elevation angle to 90 microseconds at 70 deg elevation angle. This corresponds to pulse repetition frequencies (PRF) of 67 kc to 10 kc.

By using the highest PRF at the low azimuth elevation angles, the system provides maximum possible accuracy for the shallow, forward angles where aircraft altitude must be accurately controlled, according to Joseph Winchard, FELS project manager.

Static measurements made by AIL, indicating a microwave antenna located to various heights above the ground indicate the new system can provide angular measurements with errors of less than 0.05 deg. One mile track throughout its 70-deg elevation angle range, according to Winchard.

This is the equivalent to an error of only five feet altitude at farthest transition point when the airplane's altitude is approximately 1,000 ft.

The ground area antenna is designed to scan over a 40-deg vertical sector, one half of which is used for beam transmission, at a rate which causes it to sweep up to 16 times per second. This comparatively fast scan rate coupled with the radar-catch high PRF, makes it possible for the system to provide first derivative data indicating rate of change of aircraft altitude for use by forward computer circuits and by the autopilot coupling, according to Litchfield. The FELS antenna was designed for AIL by Baffin Engineering Co., Washington, D. C.

The moderate test sector scan rate used in the FELS antenna produces high stresses on the antenna structure which suggest that it should not provide the long transmission service life which FAA requires for its facilities. With this in mind, AIL has developed an unusual type of sector scan mechanism with a minimum of moving parts which should permit a relatively long life but pending application for patents, the company is close-lipped over details.

To expedite company funding, AIL has received FAA contract covering static tests on FELS beam failure and accuracy and for construction of a second system at Atlantic City, N.J. Meanwhile, the company plans to continue work on the FELS system with Baffin here at MacArthur Field.

# Rocket Study to Assist Missile Detection

By Barry Miller



**RADARMETERS** at the apex of high-altitude rocket flights will sense electromagnetic radiation from missile launches as well as background sources. Tests are attempting to enable rockets to locate these wavelengths to selected infrared and ultraviolet bands so which maximum signal-to-noise ratios may be expected in detecting missile launches.

Accidental results in these earlier programs to determine the optimum infrared and ultraviolet wavelengths for early warning satellites to scan, in detecting and identifying hostile ballistic missile launches, will begin soon under funding from the Advanced Research Projects Agency.

Naval Ordnance Test Station, China Lake, Calif., will advance the research program with an initial funding of approximately \$2 million made available from ARPAs through the Navy's Bureau of Weapons.

The program will involve gathering and analysis of data on infrared, visible and ultraviolet radiation around in measurements contained in the test areas of three acres of high-altitude, rockets to be fired separately from several sites in the United States, Canada and Mexico.

### Short Wavelength

Short wavelength electromagnetic radiation emitted in the northern portion of the Western Hemisphere in the early, natural phenomena and our own Ballistic missile launches will be measured by the vertical radar probes. From information obtained in the program, scientists hope to develop which are the best wavelengths, given existing technology, problems of interfering radiation from natural phenomena, etc. for missile warning satellites to detect missile launches by the infrared and ultraviolet radiation emitted from their kinetic exhaust flames.

In another program designed to study similar needs, the Air Force recently awarded Lockheed Aircraft and Space Division a contract for target-to-background infrared study.

Initial rocket launches in the program is scheduled for September in October of this year. First tests should be completed by the end of 1961. No-missile launches are contemplated. Accuracy of infrared radiation, made by Arnold Engineering, will be the vehicle for the program.

### Spectral Ranges

Each rocket will contain radiometers capable of detecting infrared and ultra-violet emissions. The far infrared spectral range which requires more complex cooling mechanisms will not be covered in the program.

The rockets will be fired into altitudes and attitudes designed to simulate the portions of early warning satellites to test what the rockets' instruments will see looking down at the earth and conversely, in nearly as possible,

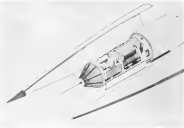
with what the satellite actually would see.

Rocket flights will take place at varied times to enable satellite data to be obtained under different conditions of cloud cover, natural emissions and night sky.

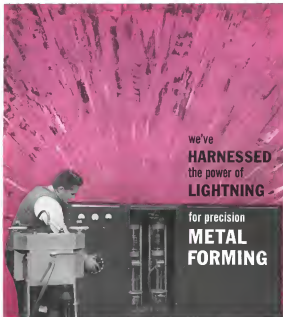
Launchings, as scheduled to take place from the Atlantic Missile Range at Cape Canaveral, from Ft. Churchill, Canada, from a launch base at Alaska, from a base in northern Norway, and possibly from the Pacific Missile Range and Wallops Island. The final areas of

rocket launches will be synchronized with surface missile launches to permit viewing and recording of infrared and ultraviolet emissions from actual missile exhaust flames.

This program will include a need for an extensive measurement of radiation throughout that wavelengths over the northern latitudes of the United States which would be similar to those reported over the Soviet Union. The measurement program is expected to provide actual data on peak detectors (infrared) of radiation versus inter-



**EXPLODED VIEW** shows instrumentation package proposed for a new high-altitude rocket study looking optimum infrared and ultraviolet wavelengths in which to detect ballistic missile launches from short wavelength electromagnetic emissions in three specific bands during powered phases of the launches.



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ity of background radiation) of a mobile monitor.

Final results of the program formally known as remote probe measurement program, will be fed into the planning for the various bulkhead rivet wiring and surveillance systems. The strength to be investigated are head-on than those selected for use in the Mideast missile defense alone system, and in such development. But the surveillance personnel, more closely up pressure than under consideration in a later ground-based system. For known as Project Loftin, now designated by the AFPA number, 162-61 (AW Apr 7, p. 11).

Investigation of ultraviolet wavelengths a further evidence of a growing interest in using ultraviolet to augment infrared sensing. In the AFPA 162-61 program, which envisages a satellite warning system more sophisticated than Mideast, combining both detection and detection capabilities, infrared and ultraviolet devices would combine to broaden the detection capability of the system. AFPA 162-61 means in the thinking stage, although in test for a study contract was scheduled to be awarded by the Air Force's Aeronautical Systems Division (AW Apr 7, p. 11). The results of AFPA's current program with Naval Ordnance Test Station (NOTS) might not detract some of the serious protection of the projected AFPA 162-61 program.

#### Program Tasks

The program will proceed in three tasks in follow:

- Task 1—Electromagnetic Radiation Background Measurement Program—This task is expected to require, on short, would involve in its own right, measurements of electromagnetic emissions from the earth in the infrared and ultraviolet spectral regions are already classified as well as this task.
- Task 2—Visual Radiation Measurement Program—These efforts are planned to measure characteristic emissions from natural disturbances such as auroras, those luminous displays which occur in their greatest frequency in the northernmost latitudes of the Northern Hemisphere. Ultraviolet spectrum aerial coverage from an extra-atmospheric rocket may prove to be a greater task in such effort.
- Task 3—Space Phase Radiation Measurement—Light sensitive retro-reflectors, rocket launchings probably from Cape Canaveral and aimed to coincide with ballistic missile launchings will measure the electromagnetic radiation characteristics of earth-launched vehicles, probably of SRIM and larger classes.

These studies of data gathered during the three tasks may answer questions about which are the high

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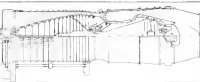
GENERAL ELECTRIC CJ805-3 jet for turboprop with thrust reverse. It shows on the factory floor at Schenectady plant.

## Air Carriers Gain CJ805-3 Experience

By David A. Anderson



LINE AND CUTAWAY views of General Electric CJ805-3 straight jet.



Breckside, Ohio—General Electric CJ805-3 turboprop now believed over the metal barriers of mechanical and performance problems is taking up its first test of 75,000 hr per month in the fleet of Delta Air Lines Trans World Airlines and Northern Airlines.

Operators are reporting about an hour per day attrition in the single speed powerplant. Problems, engine removal rate is stabilizing at about 0.1 per 1,000 hr. In-flight engine shut-downs for any reason was 0.065 per 1,000 hr at the end of April 1961, but month for which data currently are available.

### Crossover Point

On Jan. 30, first engine test was 161,000 hr., a figure approaching that of all the modern twin-engine aircraft in introduction, the J79 first flew in December 1955. Crossover point between military and commercial flight tests was expected to occur this month.

Engines are currently approved for 3,700 hr time between overhauls (TBO) in Delta service, where they have been operating since May 16 1960. They entered service at 500 hr TBO, were approved for 1,000 hr test

time and for the current work Jan. 17 1961. Current and maximum now carry a 1,500 hr TBO in Delta service.

TWA and Northeast are now operating engines with 1,000 hr TBO, lower than were only authorized to their fleets in January of this year and started service in May.

Right at the beginning of airline engine consumption was higher than the operator expected. Both engine and airplane were at fault: the drag of the Convair 440 was higher than estimated, and so was the specific fuel consumption of the GE CJ805-3 engine.

For the engine, the difference was 3% over guarantee or 6% over estimate, when the airplane was cruised at Mach 0.85 and 35,000 ft., the original flight plans for Delta and TWA Engines being checked were meeting guarantees, based on sea-level static points, but the altitude performance was off.

Two basic sets of fixes were developed by GE for the engine problem. First of these was aimed at reducing the exhaust gas temperature without reducing specifications thrust. This was done by opening the compressor nozzle area to drop the temperature. This normally would reduce thrust as well as opening the variable inlet ring, the engine pumped additional air in, compensating for the loss in thrust caused by temperature drop.

This change improved the altitude performance and also permitted pulling more thrust on a hot day. Now flying on both TWA and Delta aircraft, the change-plus dropping off the combustion and turbine case drain to eliminate gas leakage overboard has dropped the specific fuel consumption to the guaranteed figure.

Delta says this first change dropped its fuel consumption by 1,200 lb per hour.

A second set of changes, new in the world and expected to go on delivery engines in September, will schedule the variable stator program in a function of engine speed, and optimize that relationship. This change improves compressor efficiency at a given thrust and also lowers the operating temperature. Test flights with this change have been made by Convair, and current schedules call for it to be demonstrated to the Federal Aviation Agency in August on a Delta airplane.

Final rank of both changes is expected to drop the specific fuel consumption below guarantees to the right world figure. All out of the engine change program is being borne by GE.

There is one more point that is expected to help in improving engine cruise burning. The engine control for the CJ805-3 were a departure from



CUTAWAY VIEW of General Electric CJ805-3 jet engine.



OLD FIRST STAGE TURBINE (above) showing damage and new type (below).

conventional and were based on rpm monitoring. But GE is changing back to the fuel-and-thrust, pressure ratio system for better efficiency, because such a system gives more accurate control of the engine performance than did the rpm-monitoring unit.

These were the basic problems in engine performance, the new system to be complete's solved. But shortly after installing them and starting to work on improving engines to meet guarantees, mechanical problems began to show.

Delta Air Lines, first to use the GE engine on its Convair 440s, was also the first to run into some problems. In July, 1960, about two months after the start of service, airframe personnel found scorching marks during some of the post-flight. In some cases, the engines wouldn't start at all.

The trouble was caused by rubbing between the first stage turbine blades and their shroud, a Douglas-type assembly, bolted to the frame between segments so that half the bladebase was in one segment and half in the adjacent piece. Under thermal stresses, the shroud pieces would tilt up, and rub against the turbine blades. At best there was scrape

interference, with bucket metal being scuffed at the inside of the shroud. At worst, the segments were forced to bend their blades to straighten out, and to pull out of the frame and fall into the turbine, jamming it and preventing rotation.

The trouble began at about the 800 to 100 hr initial time point on the engines. By setting a tough accelerated test program schedule, GE engineers were able to produce the same trouble in about 10 hr. time. The shroud called for half time at takeoff power, and the other half half speed, steady accelerations from idle to takeoff, then ground with bursts of power.

The fix was a material and design change. From 20, the number of segments was reduced to 10, each designed with three bolts. The solid Inconel shroud segments were changed to a honeycomb assembly, with Honeyloy X replacing the Inconel material on the inner face.

This design is like that used on second and third stage turbine shrouds, but wasn't specified at the time the engine was laid out. Then, honeycomb technology wasn't advanced enough to guarantee bonding integrity at the operating

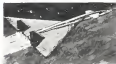


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temperatures of the first turbine stage. But progress with the cooled structure has made possible the use of honeycomb in hot-sections and GE was able to make the design change.

The new level of accelerated test was run on the test shaft, and at 110 hr inspection showed no rubbing. The test was increased to 190 hr—corresponding to several thousand hours of normal running—and the honeycomb stator rotor.

### Carbon Ball Blasting

But the honeycomb was a nuisance to inspect since the carbon balls blasted loose from the honeycomb chamber. These chunks of carbon would form during running, pull loose and hit the leading edge of the first-stage hot blade buckets. This caused some local erosion.

Centrifugal force in the turbine root drives the carbon away from the drum and loaded it. The carbon chunks ground back face in the first stage compressor stator and hit the second-stage turbine stator, and the drum. The impact cut into the blades more than into sections with the drum.

The test was run to build up the introduction of the second-stage turbine stator blades with the drum. This was done with a plasma spray of hard Coat Metal 50.

But the full fix was to eliminate the carbon build-up in the first place. Investigation showed that the carbon balls built up at a backward location on an aerodynamic development in the drum. By altering that the upstream end of this feature it could be transformed into a shape which the air would pass through cleanly, wiping off any carbon that tended to accumulate.

This fix is being made to aerobics during engine development on the engine. The ball is a simple one, and so is the operation.

Two hot-stage turbine buckets failed, for no apparent reason and with no air, according to the failure. They were run next engines through all possible regimes and no further diagnosis. The failure, so this took new blades and put them through high temperature fatigue tests. In a test short time, the blades failed and the engineers had their clue.

They found that the leading process were building in residual stresses at random locations on random blades. The solution was to work with the airlines, pulling blades and reheat treating them in even not the steels. This fixed the problem, which had happened twice again during the GE program for a total of four turbine blade failures. All new blades are now heat treated under standard precision test.

A long chain of events led to troubles with the first bearing, showing up in

four cases of spalling. The test led back through the bearing manufacturer at the ball and distribution of the first frame from the engine and using system.

This action has automatic steering that adjusts the bearing when accuracy of use has been met. The airlines and engine containing system in Concorde, but there are also some GE parts. Somewhere along the way, either the steering system or the GE shaft that was installed by the engine responded to loads and operated the auto-steering system.

When this happened on a hot day, the high thermal gradients in the first frame distorted it, because there was no way to melt off and no place for the added heat input to go. The frame distortion caused imperfections, distortion in the bearing hole and the misaligned bearing system.

Concorde, the airline team and General Electric all made portions of this. The first two caused by that part of the engine distorted it, and changed to correct method of aerodynamic action of the auto-steering system.

General Electric developed a new control valve, and a new method of control which sensed temperature. This has been no trouble since.

### Other Problems

One problem must remain, solved through up in the first-stage turbine stage design, where cooling air passages became blocked and the parts were burned in a small. These parts have been repaired or replaced, depending on the extent of the damage. But starting July 1, new parts are available, which allowed better handling of the engine air, and a material change to these, a General Electric high temperature alloy.

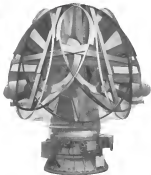
This fix will be made in an out to the airline operation.

GE reports some leakage and transfer of oil between the two systems of the engine of tank but the inner problem has been fixed by quality control. The company also says that about 100,000 hours of engine life have shown some localized cracking, but nothing that should be a repeating or unusual problem. There also has been some fretting on the longer wheel of the stator blades fit into their ring assembly, but plating of the blades has fixed that.

So far, there have been five engines removed for foreign defect damage, but about 100,000 hours of engine operation—and no engine position's removed have needed a check to date, the company says.

Only about 10 to 15 engines have been through extended in the field at Delta's workshop or at one of the two GE overhaul facilities. Scrapped parts cost is currently running between \$5 and \$10 per hour of running time.

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Kinetics has achieved extremely high dielectric strength, through unique manufacturing capability. You get the most contacts in the least space. A 100 pole, double-throw switch measures only 5 1/2" x 2 1/2" x 2 1/2", and weighs only 5 lbs., yet each contact can carry up to 15 amps continuously. Other switches would weigh just a few ounces and are smaller than a pack of cigarettes.

Kinetics products are used on many systems for status power changers, range safety systems, destruct circuits, telemetry applications, battery transfer and a host of other applications. They are now in use on virtually all of the major missile programs. For help with your switch requirements, write to please Kinetics Corporation, Dept. K-A-T, 438 South Cedros Avenue, Solana Beach, Calif. 92088 615-751-1171.

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## ENGINEERING & ADMINISTRATION

Individuals adding a monthly commitment in a growth industry job opportunity to write or read our Journal in Solana Beach (San Diego County) Calif. An option should be checked in Program 1, South Staff Employment.

**KINETICS** 

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## Indians Test HF-24 Supersonic Jet Fighter

First supersonic aircraft designed exclusively in India, the Hindustan Fighter 24 is shown in an early test flight (above). Manufactured by the Hindustan Aircraft Factory, the plane is powered by two Oryx 3 engines but ultimately will be powered by more powerful Oryx 12s developing 5,000 lb. thrust. Aircraft is designed to be equipped with an array guided missiles. First production model is expected within a year—Indian air force will get priority on deliveries but India also plans to sell the planes to neighboring nations.





## NEW J&H AIR-START COUPLINGS PROVED FOR SERVICE TO 600F

Fully tested to MIL-C-25331A, J&E's new 3" quick-acting air-start coupling not only met all specified requirements in operating at 600V, but showed extremely low crevice drag and zero arc leakage.

In addition to these prime capabilities, the new crapping offers the following advantages to the military or commercial user:

- eliminates hose whip
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Two versions available. The basic, proved coupling design is being offered in two versions . . . military and commercial . . . to meet the special requirements of each of these two user groups.



**MILITARY AIR START**—Two military types available. One for use with fixed-wing aircraft, the other for use with rotary-wing aircraft.

**COMMERCIAL AIR-STRUT**—PCB handling where a lot of manures, animal products, human and pet waste, blood, urine

For details on the design and performance of these new J&H air-start couplings and for further information on other J&H air-start accessories, simply fill in and mail the coupon below.

JACK & HEINTZ, P. D. *Ann. Entom. Soc. Am.* 1976

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For further information, contact: **Dr. Robert J. Goss**, Director, Canadian Academy for the Neutral and Impartial

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2. *Hydrophobic Fluoride PA Synthesis*  
A. *N*-[3-(1,1,1-trifluoroethyl)propyl]amine (1.0 g, 4.0 mmol) was dissolved in 10 mL of THF and 1.0 g (4.0 mmol) of NaH was added. The mixture was stirred at room temperature for 1 hour. Then, 1.0 g (4.0 mmol) of 1,1,1-trifluoroethylamine was added. The mixture was stirred at room temperature for 2 hours. The mixture was then poured into water and extracted with diethyl ether. The organic phase was dried over anhydrous sodium sulfate and concentrated under reduced pressure to give the product. Yield: 0.5 g (50%).

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*The important advances in environmental testing come from AIA*



**Production random vibration now practical**  
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ME's completely automatic spectrum analyzer simplifies test procedure and makes production random vibration testing practical. It effects tremendous savings in test time and money for clients and aircraft manufacturers.

The unique, set-up-time has been completely eliminated. Using solid state integrative filters with correct phase properties plus zero state systems on each of eight channels in the 15 to 2000 cps spectrum, vibration shaker systems can be completely installed within 30 people.

Savings in time and labor over previous equalization methods can easily mean thousands of dollars per minute tested. SDI another advantage is the greatly increased security of accumulated test data. The spectrum is continuously monitored in narrow bandpass channels and compensation automatically made during test run.

Automatic spectrum equalization is another of MIF's important and outstanding contributions in the field of environmental testing.

Heart of the 80 automatic speaker line system is the multi-channel interlocked amplifier which provides amplitude control. The plug-in printed circuit assembly shown above controls four of these channels. Frequency control is provided by the 80 channel filter assembly in the compact metal box.

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**Electronics duplicate naval maneuvers on an ocean miles wide and fathoms deep—captured within the confines of a single building.**

The view through the periscope of Honeywell's attack center for the *Belmonte Ticonderoga* will be as realistic as the view through the periscope of an actual atomic submarine! As enemy or mine targets will maneuver at proper speeds and change heading and size as their courses diverge. Different types of weapons will make hits or misses as they would in actual individual or coordinated attacks, or defenses, without the expense of actual maneuvers. Effects of pitch and roll, night or day, fog or sunlight on the view will be imposed. All this will be programmed into the trainer once each month by a Honeywell 800 computer.

In short, the men being trained in these attack centers will have the feeling of engaging in active maneuvers. The flexibility of a Honeywell 800 computer will enable officers to experiment with new tactics and evaluate whether or not those would succeed or fail in actual practice. Two coordinated centers and a console room will allow participating officers to conduct war games, change programs, change tactics and check performance of the attack center teams. The system can handle one or four problems simultaneously and thus submarine attack center crews can be trained separately or as a team.

Thus, without an actual or dummy heading post, or the expense of actual maneuvers, a thorough training job can be done. Costing only a fraction of the cost of a submarine, the answer is a good example of our dollars wisely spent. Honeywell, as prime contractor, is developing and building the trainer at its Ordnance Division facility, Duarte, California, under the direction of the Naval Training Device Center, Port Washington, N. Y., for the *Belmonte* School in New London, Conn. For more information on Honeywell management capabilities in the design and production of simulators and trainers, contact your local representative, or write Honeywell Military Products Group, Minneapolis 8, Minn. Today and serve often in all principal areas of our world.

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## Grumman Gulfstreams set outstanding utilization records! Fly 68 million passenger miles since May 1959

One Gulfstream, owned by George W. Crothers Limited, traveled 171,000 passenger miles in just one week!

68 million passenger miles! 35,000 flying hours! All in just 26 months, from F.A.A. certification in May 1959 to July 1961.

This is record utilization in its best... record utilization that only a Gulfstream can deliver. For it is the only aircraft in its class designed exclusively as a business airplane!

The result: the Gulfstream offers unique flight and ground flexibility. It's the most do-everything business airplane there is—one of the most useful and capable business airplanes in the world!

For a good example of this, just consider the experience of George W. Crothers Limited of Toronto, Ont. This company's Gulfstream traveled 171,000 passenger miles in just seven days!

Starting on a Monday and for seven consecutive days on a daily basis—the Crothers' Gulfstream ran scheduled trips between Toronto and Tampa, Florida. The purpose of these trips was to recruit top Canadian customers to Tampa for demonstration of a new line of tractors handled by Crothers Limited.

The seven-day Crothers flight log tells the Gulfstream utilization story with dramatic detail.

	DEPARTED	ARRIVED	DEPARTED	ARRIVED
Monday	Toronto 07:57 FL Landerholm 14:35	Tampa 12:04 Toronto 17:25	Tampa 12:40	FL Landerholm 13:26
Tuesday	Toronto 07:10	Tampa 12:21	Tampa 12:56	Toronto 17:06
Wednesday	Toronto 07:24	Tampa 12:45	Tampa 12:47	Toronto 16:44
Thursday	Toronto 07:32	Tampa 12:39	Tampa 12:56	Toronto 16:34
Friday	Toronto 07:27	Tampa 12:42	Tampa 12:56	Toronto 16:37
Saturday	Toronto 07:15	Tampa 12:25	Tampa 12:56	Toronto 16:32
Sunday	Toronto 07:34	Tampa 12:05	Tampa 12:37	Toronto 16:22

Flight performance like this—performance that makes the Gulfstream stand for 73-mile or 3100-mile trips—is one reason why 73 Gulfstreams are now in operation. Other reasons are Gulfstream's proven safety, reliability, comfort and beauty. It's a sound investment.

Corporate executives and pilots may arrange for demonstration flights through the following distributors: In the United States: Atlantic Aviation, Washington, D.C.; Pacific Aerospace, Santa Monica, Cal.; Southwest Aerospace, Dallas, Tex.; In Canada: Trans-Canada Aviation, Montreal. In Europe: Atlantic Aviation Export Corporation, London, England.

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## "MASTER CLOCK"

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The Timing Operations Center designed and built by Epco-West for the Navy's Pacific Missile Range is now in use at Point Mugu, California. It makes use of 15 Honeywell Viscorders to read out (see photo on the unnumbered record at left) the modulated timing codes distributed as balanced outputs to the Center's "customers."

The mid-wide Epco-West TOC generates up to 12 separate timing signals, one or all of which may be delivered to any of 36 users.

The 908B Viscorder also performs a supplementary function as a monitor on the timing and test-catch panel, and as permanent "trend logger" for the built-in indicators and test on diagnosis. Viscorders were selected for their jobs with the TOC because of their versatility, reliability, low cost, and compact size (110" x 10" x 15 1/4" weight, 37 lbs.).

Proven and acknowledged standard in the field of high frequency direct recording oscillography, the Viscorder is available in several models, from 6 to 36 channels, DC to 5000 cps recorder, up to 50,000 cps strip speed. Honeywell engineering is at your service through 120 field offices for help in applying one Viscorder or a full system to your data acquisition program, or a quantity of Viscorders for GEM application in your products.



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## SPACE TECHNOLOGY

### Space Role Seen for Small Rocket Family

By Russell Hovles

Canoga, Pa., Cold—Family of smaller rockets designed to operate in deep space is under development by Rocketdyne Division of North American Aviation as a complement to its big booster program.

The company-funded program is based on a conclusion that there is a large gap between chemical rockets now being designed for spacecraft and proposed nuclear and nuclear-electric systems. Rocketdyne believes space program officials will soon reach the same conclusion and hopes the company-funded project will provide a competitive edge.

The Small Space Engine project is aimed at the development of three or more rockets in three basic size ranges for three general categories of applications. The three lines of effort are designated SF 1, SF 2, and SF 3 size ranges and proposed applications are:

- SF 1—Altitude control engines producing from 0.1 lb. to 500 lb. thrust
- SF 2—Boost and orbit change engines developing 10 lb. to 10,000 lb. of thrust
- SF 3—Spacecraft propulsion systems in the 5,000 to 10,000 lb. thrust class

First SF 1 engine was called Nomad. It was evaluated by USAF and developed. Rocketdyne engineers are now working on another SF-5 engine of more advanced concept called Nomad. The new SF 1 chamber is uncooled. Test firing has been conducted at Rocketdyne's Santa Susana Space Engine Test Facility.

#### Other innovations

In the smaller SF 1 and SF 2 class Rocketdyne is working on three other innovations: a throttleable liquid propellant rocket with propellant flow controlled by varying the cross-sectional area of the injector opening, a multi-tube cooled, then wall chamber, and an ablation or transpiration cooled chamber of glass fiber and steel laminates. Rocketdyne projects aimed at a general advance of the technology include development work on jetting propellant valves and techniques of passive expulsion of propellant from tanks under low or random accident loads.

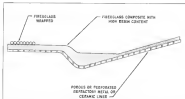
The variable area injector is somewhat similar to one developed by the Naval Ordnance Test Station, China Lake, Calif. Propellant flow is throttled by abutting in retracting a taper-



ARTIST'S CONCEPTION of experimental SF-1 spacecraft attitude control engine, which has made test runs of up to 15 sec, shows light tapered leads in tension structure. Small spaces permit propellant injection. Model.



CUTAWAY of the experimental SF-1 system shows positive expulsion nozzles in the propellant tanks. The small space engine also was used to test fuel mixing without valves and has been stopped and restarted at pulse rates up to 26 cps.



ADVANCED SF-1 small engine will be based with porous or preformed ceramic or refractory walls. Transpiration rather than ablation cooling should cut weight 30% by allowing a higher rate of cooling from structural glass to chamber walls.

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Turbine-powered Sikorski HO4S



1300 turbine-powered HO4S, Sikorski

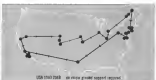


1300 turbine-powered HO4S, Sikorski

## TURBINE-POWER DEVELOPMENT...IN CONTRACT PERFORMANCE...



1300 turbine-powered HO4S, Sikorski



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1300 turbine-powered HO4S, Sikorski



4 Page 431 on ground

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edged, ring-shaped tubes in low-velocity propellant tubes. Part 1 and 2 is injected from the inner side of the ring in an expanding cone-shaped pattern and another is injected from the outer side of the ring in a cone-shaped pattern.

Unlike the China Lake development, the Rocketdyne thrust chamber has vented surfaces so that propellant flow into the chamber is ribbons whose width and thickness are both controlled by the position of the ring-shaped tubes. The China Lake engine injected fuel from one side of the ring and oxidizer from the other in intersecting concentric sheets of liquid and gas. The thrust could be varied. Rocketdyne engineers claim that by breaking the usual sheets of variable width, they can accept the strongest gas-loading stresses of the ring-shaped tubes.

### Thrilling Rapids

Using this approach, Rocketdyne has achieved a 15 to 1 thrusting ratio with thrusts as low as 75 lb and as high as 1500 lb from the same chamber. Rocketdyne engineers who designed the variable area injector admit that breaking propellant flow into ribbon-shaped streams causes some departure from the best two-dimensional burning, because the streams cannot be made to impinge on each other with perfect accuracy. How-

ever, they believe that the efficient use of propellant made possible in thrusting ratios the loss might be compensated.

Regenerative cooling is impractical with the thrusting engine. A regenerative cooling system designed to be adequate at maximum thrust would not function satisfactorily at low thrust levels because the pressure drop from the inlet to the outlet of the cooling jacket would be too small and flow rate would drop below that needed to carry off the heat flux into the chamber walls. Regenerative cooling is also being considered in SR-71 pulsed engines in which pulse rate and width rather than thrust are varied to control the total impulse applied to the vehicle. Regenerative cooling causes a lag in start-up sequence because the cooling jacket must be filled before ignition and the jacket cannot be left full between burning periods because the propellant tends to boil off. Rocketdyne engineers say these problems can be solved but the solutions would be costly.

Instead, they returned to defining chambers cooled by induction and by ablation or transpiration. The company has successfully tested an improved SR-71 test engine that includes all the best parts of the previous design. The chamber is made of welded segments of molybdenum alloyed with 170 b-

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SECTION 30-1 test engine after firing shows the relatively undamaged glass head/section of the chamber and the expansion cone. Disruptions are only slightly changed through some limitations have cooled out from between the glass layers to provide a cooling boundary layer. Engine ran for 22 min. during the test.



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temen. Rocketlike efforts believe it is the first time such behavior has been welded successfully in a method suitable for production scale use. The walls are shot with an inertial jet heat shield.

Thickness of the walls is usually constant 0.015 in. throughout. The walls reach equilibrium and radiate heat at the same rate it is added from the combustion chamber after less than two seconds of operation. Thus, it is as if a rocket were to the length of time the chamber can operate without heat damage over equilibrium is reached. Equilibrium temperatures in burn have ranged between 2,500° and 2,600° burning hydrogen and nitrogen tetroxide. With latter having high performance propellants, metal chambers can accept an equilibrium temperature up to 3,000°.

#### Test Engine

The test engine is designed to develop 120 lb thrust at altitude and tests have been conducted at 55 psi chamber pressure. The weight of the chamber is set at 8 lb with a 40 to 1 expansion ratio.

Rocketlike engineers say that a conventional chamber developing the same thrust at the same chamber pressure would weigh about eight times as much.

Propellant lines between the tanks and the injector are single thin tubes to prevent heat loss being conducted forward into the tanks through unshielded walls and structure. The narrowed flow of propellant in the thin tubes leads to more conducted heat back into the chamber.

Prevention of damage to the rest of the vehicle by radiated heat will be an important problem in the design of a full-scale for the industrial cooled engine.

During one of the static tests the rocket motor of a data camera lens was heated and was removed by radiated heat at a distance of about 16 ft to one side of the motor. Solution in the design of a spacecraft would be a mirror-like reflector to take radiated energy away from other parts of the vehicle.

Rocketlike engineers say that radiation cooling would be even more effective in space than in the laboratory. It is true that there may be as much as 35% heat rejection by conduction and convection in the atmosphere ground test but the effectiveness of radiation properties is lowered by the higher energy "back-pressure" of the atmosphere.

The small plus and plastic engine which looks more promising for SE-1 application has a form of ablative cooling that is very similar to impingement cooling in the combustion chamber.

Too, the first bench television's top performer in instrumentation tape is strong—and it goes to show the fact that the same expert team produces the best at both. "SCOTCH" brand Heavy Duty Tapes show a complete heritage—and consistent endurance—with "SCOTCH" brand Video Tape. The tape that puts a network TV show on the next "clock time" from Miami to California.

Scotchman wants nothing between the two: a similar high-temperature binder system, known as "SCOTCH" BRAND high purity oxides, a similar ability to record tremendous speeds, pressures and temperatures while providing high resolution.

Let's look at the record of "SCOTCH" BRAND Video Tape and see what message it has for the user of instrumentation tape. On a standard roll of video tape like that shown here, some 115 mils (mils) per second must be packed to the space width—or a total surface area equal to the size of a tennis court. The tape must provide this kind of resolution while deferring the degrading effects of high speeds, pressure as high as 10,000 psi and temperatures up to 250°F.

The fact is that video tape must be essentially perfect. And it's a matter of record that thus far only the 3M experts have mastered the art of making commercial quantities of video tape that consistently meet the demands of the application.

Specifically, the high-temperature binder system developed for "SCOTCH" Video Tape is first cousin, only slightly removed, to that used in the Heavy Duty Tapes. It's this special feature that has given Heavy Duty Tapes their exceptional wear life.

Low thermal expansion for tape that provides the best resolution of high and low frequencies under the severest conditions, first to "SCOTCH" BRAND Heavy Duty Tapes 418 and 419.

They offer the high speed heater binder system, plus the same high quality and uniformity that distinguishes all "SCOTCH" brand Tapes. As the most experienced tape-makers in the field, 3M research and manufacturing experts select tape of highest uniformity from roll to roll and within the roll. Check also the other "SCOTCH" BRAND constructions: High Resolution Tapes 437, 438 and 439; High Output Tape 425; Standard Tapes 422 and 424; and Standard Tapes 420 and 421.

See 3M Representative or close at hand at all major cities. For more information, consult him at Video Magnetic Products Division, 3M Co., St. Paul 6, Minnesota.

SCOTCH is the first name in magnetic recording in the 3M Company. 3M Co., Dept. 500, Dept. 500, St. Paul, Minn. 55101. 3M Co. is a registered trademark.

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## PRODUCTION BRIEFING

**Closer Technology Corp.**, Fortran, Calif., will study feasibility of a magnetic induction plasma engine for space vehicles under a contract valued at \$100,000 from NASA. Development will involve single shot and repetitive firing engines utilizing induction force between a traveling magnetic field and a plasma stream.

**General Dynamics Automotive** will build three Atlas missile production trailers for the Air Force under a \$2.5 million contract. Two of the trailers will be delivered to the 57th Strategic Missile Squadron at Vandenberg AFB later this year. The trailers require no fuel gas or other expendable materials, will be used in loading with special procedures in checkout, crew assignments, readiness monitoring, countdown and simulated launching. Trainers cover an area 90 x 90 ft.

**Cable Corp.**, San Diego, has received a \$180,000 contract from NASA for updating the space probe tracking network at NASA's Wallops Island, Va., station.

**Pan American World Airways** has awarded an \$17.7 million contract to upgrade the Atlantic Nucleo Range, for fiscal 1962. Used for FAA is \$1.75 million. The same amount is in fiscal 1963.

**National Research Corp.** has a \$60,900 National Aeronautics and Space Administration contract to study the effects of the space environment on six types of bacteria.

**Northrup Corp.** has a \$62.5 million Air Force contract for production of 118 trainers, spares and ground equipment.

**Larsoning TVD-435 turbo-supercharger** engine currently in production for use on the B-57C-40, has been authorized by the FAA.

**Weiss Flugzeugbau GmbH** will establish a service facility for maintenance and repair of the Lockheed Jetstar at Remond, West Germany. Weiss will service the first Jetstar operating in Europe.

**Lockheed Aircraft Corp.** has signed agreements with Fiat on an F-104 production program which includes a final assembly line at Fiat's Turin factory and participation by Aeromobili Macchi and Aeritalia. Alfa Romeo is scheduled to take part in F70 engine production under General Electric license, probably with Fiat in Milan.

The program is to be coordinated with F-104 production in West Germany, Belgium and The Netherlands.

**Alcoa-Kaiser Corporation** plan to issue a joint bid. Northing Corp. engineering contractors at a 100-lb. Type 707 jet engine motor at the company's Public Radiation Facility, Hirthsburg, Calif. for use in studying radiation effects on space vehicle systems and components.

**Chicago Aerial Industries** will install reconnaissance systems in Army's Greenham, Missouri, aircraft under a \$540,000 contract to develop reconnaissance control, valued at \$1.5 million, provides for continued production of two reconnaissance systems for use in September 1963. The two contracts, totaling more than \$7.1 million, cover CAI's order backlog to more than \$7 million. The two contracts feature a proprietary feed plane system that operates at 1/100 sec. or about seven times faster than previous system standards.

**Hughes Aircraft Co.** will develop plastic materials to line missile vehicle interiors under a \$124,000 contract from Air Force's Aeronautical Systems Division. The contract also calls for development of self-cooling technologies for the plastics, which are intended to resist high-temperature and chemical attack, exhaust of advanced propellers.

**Minnesota Mining and Mfg. Co.'s** Zurich Plastics Division will develop prototype scattered plastic containers for transporting Air Force Minnesota JCRMs by air and rail under a contract from The Boeing Co. Value of the contract is approximately \$350,000.

**Morganti Corp.** will develop a board-level manager radar tracking system under contract from Air Force. Designated MK 999/AQ-718, the system will be used by Strategic Air Command and Air Training Command for training of B-52 bombardier and navigator on simulated tactical operations. With a trainer map measuring approximately 72 by 45 in., a load and store area 1,000 by 1,000 sq. cm. is represented on the radar scope.

**Space Technology Laboratories, Inc.**, will investigate feasibility of techniques using printed circuits and magnetic recording for sensor use, under a \$198,521 order contract from Navy's BuShips.

**Elktone Division (M&E)** of Thokol Chemical Corp. has received a \$402,000 contract to conduct U.S. research on high-velocity solid propellant fuels.



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... EXTRUDED**

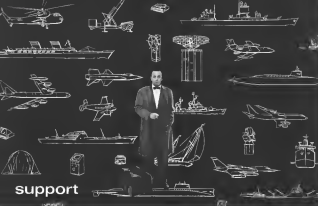
The aluminum extrusion in the picture is a metal-working "flex". It is 18½ in. wide and has 24 internal passages running its entire length. Passages are ½ in. wide, 1/8 in. high and spaced ½ in. apart.

The extrusion is cut to required lengths to form panels. The panels are made into pressurized cabinets that house electronic equipment for high-altitude aircraft. Cool air forced through the passages air-conditions the equipment for greater operating efficiency. These panels or similar extruded parts could also carry gases or liquids to overcome heating or cooling problems in other applications.

### CALL ON ALCOA'S CAPABILITY

This extrusion "flex" is a significant example of Alcoa capability at work. Alcoa... where the men, the metal and the machines can roll, forge, extrude or cast the solution to your metal problems. How can we help you use this capability? Write: Aluminum Company of America, 1670-S Alcoa Building, Pittsburgh 18, Pennsylvania.

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ALUMINUM SUPPLY OF AMERICA



Maximum performance for the military...maximum satisfaction for the industrial customer...these are the goals of Sperry field engineering. A specialized division of personnel expertly trained in application, installation, operation, maintenance and overhaul, it provides on-the-spot engineering support for Sperry's wide-ranging products and systems. There are three integrated support functions: (1) customer training and product orientation; (2) field activity including on-the-job training, application engineering, installation, repair, product improvement; and (3) comprehensive overhaul centers strategically located.

With 50 years of professional experience, Sperry field engineering puts a unique support capability at the service of Sperry customers world wide. General offices: Great Neck, N.Y.



## JPL Simulator Will Test Mariner A

By Irving Stone

**Prodena, Calif.**—Space simulation chamber to evaluate final design of spacecraft under realistic environments will be completed by the end of the year at NASA's Jet Propulsion Laboratory here.

Mariner A, NASA's JPL-developed Venus flyby probe (AW June 12, p. 57) will be the first spacecraft tested in the new facility. Mariner A is 5 ft high and weighs 70 lb, with solar panels extended. First Mariner A flight is scheduled for late 1962.

The simulator is a cylindrical tower 56 ft high and 27 ft in diameter.

The lower part of the simulator contains a stainless steel vacuum chamber 47 ft high and 25 ft in diameter, for housing the spacecraft. A 10,000-sq-ft building containing a control room and equipment area will house the simulator. The upper portion of the simulator simulates the solar illumination and artificial sunlight is generated by 150 arc incandescent lamps, each using 2.5 kw and fitted with a 15-in. reflector.

Light from the mercury vapor lamps shines down onto a parabolic mirror which reflects it up in a concentrated beam onto a hyperbolic mirror which, in turn, reflects the beam downward through a 5-ft-dia lens into the vacuum chamber. Inside the chamber the 5-ft beam impinges on a 2.5-ft-dia mirror which reflects it up onto a parabolic mirror at the top of the cylindrical chamber. From this mirror the light shines down onto the spacecraft in a concentrated beam, similar to sunlight in space. Plans are to modify the simulator to permit the projection of a 25-ft beam.

### Variable Lighting

The lighting system will be variable so realistic sunlight intensity is spacecraft would encounter as near to the Sun as Venus as far away as Mars.

An ultraviolet diode inside the chamber is composed of 200 plates finished with black, so absorb heat and cooled to minus 510°F. Temperature is maintained by pumping liquid nitrogen through tubes running through the diode. This system absorbs and carries away 99% of the heat radiated from the spacecraft. The design is in keeping with the philosophy that if the spacecraft is well designed it will absorb some of the heat projected onto it in space to keep its thermal balance near the optimum level, while the rest is reflected into the infinite of space.

The vacuum in the chamber is created with a three-stage pumpdown



**JET PROPULSION LABORATORY** designed space simulation chamber (above) is lowered into place at new Space Simulation Facility at Prodena, Calif. Art's conception of the new building (below) shows tower for housing artificial sunlight system. Chamber, which weighs 55 tons, sits on casters below. Producers on chamber are ducts which will lead to vacuum pumps. Aluminum sheet made chamber has 200 plates to absorb heat.

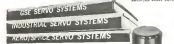




**STRATEGIC AEROSPACE CENTER** • **Lockheed/Georgia**  
 is next door to Huntsville and Cape Canaveral. This strategic geographic location eliminates excessive transportation costs, makes technical liaison more efficient, and reduces the overall time span of aerospace programs. And the Georgia Division is big enough physically to handle any program yet conceived—big enough in capability to take on the full gamut of advanced research and manufacturing jobs. **LOCKHEED/GEORGIA**  
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 AEROSPACE SERVING SERVING



Since its inception, Raymond Achley has developed many servo systems for both the military and industry—from missile controls to industrial automation. Years of experience in servo components and systems has been responsible for numerous and unique control systems. Achley's research and development staff is currently investigating universal new, pioneering control techniques for both aircraft and space vehicles. If it's a system involving electronic, hydraulic or pneumatic servo controls, consult Achley.

**Raymond Achley Division**

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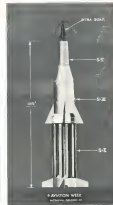
### ACHLEY'S Jet-Pipe SERVOVALVE

• operates despite contamination

When a servovalve is forced to operate in contaminated fluid, the result is a servovalve that is no longer a servovalve. Achley's Jet-Pipe Servovalve is designed to operate in contaminated fluid, and its jet-pipe design makes up for the jet-pipe.

water. The first stage incorporates stress components, followed by a roughing stage consisting of three concentric layers, which remove all but a small fraction of the metal on top of the surface. The second stage is a precision grinding to produce a surface of 0.0001 inch of accuracy, about one-hundredth of the thickness of a sheet of paper. The grinding process is varied continuously during tests to monitor polishing or expansion from the chamber.

The specimen will be positioned in support by means of a landing cart. Each particle in the chamber will permit observation of the specimen during a simulated space exposure. Ejectors in the control room will



### Dyna-Soar Study

Use of Saturn to launch the Dyna-Soar vehicle is under study using full boost stages, S-IV second and S-V third stages. Boost phase control system may be modified to include fuel or oxidant on the first and second stage retrofires. As vehicle Dyna-Soar engine vehicle would be expected to weigh approximately 25,000 lb, with a body diameter of 10 ft and a length of 17 ft. The S-V stage would be incorporated as the vehicle stage if Dyna-Soar was used for earth escape missions.



## The Uses of Space

Man is the searcher. He has a driving urge to know. After centuries of speculation, we now know that the world of space is infinitely more vast even than in our dreams. How shall we rise to the challenge of space knowledge? Ask any scientist and he will tell you: space is not something to be conquered but to be used—for reconnaissance, instant world-wide TV and radio communications, weather forecasting and basic research. Where will it all end? It never will.

Shown above is one feature of Republic's Space Emulation and Life Sciences Laboratory, largest space chamber in the nation capable of testing man and space systems at simulated altitudes of more than 100 miles. Republic's new Research & Development Center is the only fully integrated industrial research complex engaged in every vital area of space investigation. Eight laboratories comprise the Space Emulation and Life Sciences. Six flying simulators, altimeters, simulators, motion simulators, gyroscopes, and other test equipment are used to simulate the conditions of space flight. Republic's Space Emulation and Life Sciences Laboratory is the basis of Republic's wide-ranging application of every field of space knowledge.

## REPUBLIC AVIATION CORPORATION

WABAM NATIONAL, LONG ISLAND, N. Y.





## He designs antennas for every purpose except this one

He's one of a staff of AMF engineers which has been designing and producing precision radar antennas and components since early in '46. If AMF's accomplishments reflect the team effort, teamwork experience and complete fabrication capability made available for each project.

Here are highlights:

**Fixed base**—AMF's experience in designing automatic machinery was utilized in the 16,000-lb AN/SPS-13, the famous "Dev Line" antenna, designed and built by AMF to operate satisfactorily under fantastic arctic conditions.

**Mobile**—AMF designed and built AN/SPG-10 precision tracking antenna that demands zero shock-resistant, unmovable components. AN/SPG-4 and 16 are AMF-designed trailer and truck-mounted types.

**Stabilized base**—Design and fabrication of 36, AN/SPG-5N High Gain Antenna, AN/SPS-3 Dual Foster Scanner.

**Precision paraboloids, fixed-focus**—AMF's Precision Instrument Mount is controlled by optical digital discs accurate to 0.0001 mil/radian. It controls motion and azimuth.

**Relay joints**—A special AMF capability requiring utmost precision in design. Example: multichannel joint for AN/SPS-84 System.

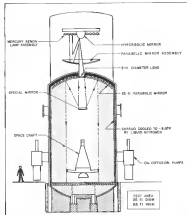
**Sevens, Fords, Sevens and Sevens**, Ball-bearing Phase Shifters, Hydrostatic Bearings, Slip Rings, Programming, Test, Control and Display systems are all part of AMF's radar capabilities. AMF also operates its own test ranges.

For more information, write American Machine & Foundry Company, Government Products Group, 241 Madison Avenue, New York 16, N.Y.



AMERICAN MACHINE & FOUNDRY COMPANY

In engineering and manufacturing AMF has ingenuity you can use.....



**CUTAWAY DRAWING** of the FL space radiator shows arrangement of lighting system, vacuum chamber and liquid nitrogen-cooled shield to insulate conditions of outer space.

insulator resistant to the space environment of the spacecraft's transmitting and receiving equipment, guidance and control system, and instrumentation.

The conductor is being constructed by a group of scientists sponsored by Consolidated Vortex Corp., Rochester, N. Y. Their subcontractors include Ampco General Corp.'s Astro Division (design of lighting instrumentation and external structure), Black & Lomb (design of solar condenser system), Texas Engineering Corp. (thermal properties and power system for lighting) and Physics Dev. Assoc. (Steel Corp. fabrication of vacuum chamber and assembly and erection of entire facility).

## Centrifuge Can Test Multiple Specimens

Centrifuge for creep testing up to 32 specimens at once has been developed by Ampco General National Division for the Atomic Energy Commission. The centrifuge tests can operate at temperatures up to 2,000° and stress

levels up to 900,000 psi. Specimens to be measured while the machine is rotating. Strain sensors at the bottom of each specimen are about 1/4 inch thick of an inch long. Specimens are placed in the centrifuge about once every two days and can be cut off-center to permit tests at multiple stress levels simultaneously.

A separate sensor will be delivered to AMF for creep testing inside a nuclear reactor. Some nuclei are activated by neutron effects and the centrifugal rotor will be able to obtain information about the creep strength of materials during irradiation. With more precise knowledge, it should be possible to reduce over-design safety factors that compromise fuel life of data.

Data from single tests have been limited in the past because only one or two specimens could be tested inside the reactor at one time. The large amount of reactor time needed for great amount of data resulted in high cost per specimens. The centrifuge should reduce it to a fifth of the present level. After just three the cost will be no more than that of three single-specimen conventional creep tests.



# FIAT G 91 T universal trainer



Cockpit

## TRAINING

Universal trainer capable of carrying through pilots from the initial flight training to operational mission

## OPERATIONAL MISSIONS

It preserves all the main features and possibilities of the single-seater and, therefore, can be used as an operational lightweight tactical aircraft.

FIAT - DIVISIONE AVIAZIONE  
CORSO G. AGNELLI 200 TURIN (ITALY)

## New Offerings

These Manufacturing Co., Menlo Park, Calif., principally engaged in the design, development, manufacture and sale of aerial cameras and photogrammetric instruments, electronic test equipment and communications equipment, substantially all its sales are made at present to various agencies of the Federal Government, including the Air Force, the Army and the Navy, as to companies engaged in work for such agencies.

Offering is 325,000 shares of common stock. Of this stock, 300,000 shares are reserved for issuance at a price to be determined by the board of directors, the remaining 25,000 shares were acquired by the General Corp. from L. D. Roberts on Sept. 15, 1956, for \$75,000, and 2,500 shares were sold to Mrs. R. Francis Taylor, assistant secretary. Options for 275,000 shares are now outstanding, exercisable at \$2.50 per share (except as to 4,000 shares which are exercisable at \$4 per share). The shares being acquired may be offered for public sale free time to time on the American Stock Exchange by the person to whom the stock has been or may be issued, at prices prevailing on the Exchange at the time of offering. The company intends to apply the net proceeds of shares issued upon the exercise of options to its general funds.

Texas Industries, president and board chairman, and members of his family are owners of all the stock of General Corp.

Ford Haddock, Inc., San Francisco, Calif., organized under Delaware law in March, 1963, the company is the successor to a California company of the same name. In April, 1959, all of the predecessor's outstanding capital shares were acquired by Classical American Corp., in exchange for the predecessor's common stock. When the present company was organized all its outstanding shares were issued to Universal in exchange for three of the company's predecessor, which took because a wholly owned subsidiary of the company, until acquired into it in March, 1963. The company engages generally in the design, engineering, construction and installation of scientific buildings and related facilities for the armed forces, and complex, high-class of various types for agencies and contractors of the United States Government and for the aircraft, electronic, chemical and petrochemical industries.

The offering is 150,000 shares of common stock for public sale, payable to be supplied by subscription. Proceeds will be used for general corporate purposes, as working capital, in order to expand the size and scope of its business by enabling it to bid on more and larger contracts. In addition, such working capital will be used to pay indebtedness to Universal and to expand the company's activities in its actual construction projects, in construction as well as military and government fields and also may be used for the reduction of any outstanding bonds.

An Rockwell Company, Inc., New York, N. Y., has sold a registration statement for 100,000 shares of common stock, to be offered to officers and other executive employees of the company pursuant to its 1957 Stock Option Plan.

Finchfield Stokes Corp. has acquired Tulsa-Norris Laboratories, Verdell, Okla., which specializes in pharmaceuticals. Finchfield also acquired the assets of a Tulsa-Norris affiliate, Advanced Pharmacy, Inc.

Manila Co. and American-Manitoba Co. boards of directors have reached agreement on a merger proposal to present to their stockholders. The merger would be accomplished through an exchange of stock. American-Manitoba is a producer of building and household supplies and sold under the

## FINANCIAL

### Financial Briefs

United Aircraft Corp. has completed private placement of \$7.5 million in 5% making fund notes. Chairman H. M. Howe had and under the year first United was considering a \$10-million bond issue to replace some of United's short-term bank loans with long-term notes (AW Feb. 15, p. 55).

Dynasticon Corp., Washington, D. C., is the new name voted by stockholders of California Eastern Aviation, Inc. The name change is said to reflect the diversified nature of the company's aircraft and its interest in the aerospace field as long as an aircraft.

Spern Road Corp. has organized a General Marketing Corp. to coordinate the marketing activities of the company's defense activities. The group is headed by Malvern H. Jennings, for such marketing director at Aero-Worldwide.

The marketing group breaks down its activities into the following three categories:

- Market research and long-range planning
- Program coordination
- Overseeing regional market offices.

Forecasts of the General Marketing Corp. follows in the hands of the creation of the Spern Road Corp. which handles overall management and technical coordination between the firm's divisions and personnel from the marketing group are scheduled to work closely with the company's internal organization.

## Pacific Air Lines Plans Public Offering

San Francisco-Pacific Air Lines, Inc., a local service carrier with routes in California, Oregon and Nevada, plans a public offering in August of \$100 million of 6 1/8% convertible subordinated debentures and 150,000 shares of its common stock per share at \$6 each per share.

The securities will be offered only in packages of debenture plan stock. Each package will consist of debenture principal of \$100 and 10 shares of common stock.

Packages cannot be separated until January, 1963.

Company will not proceed from an offering sale to pay indebtedness incurred by it in purchase of new aircraft and engines, remodeling and modernizing flight planes, and for general corporate purposes.

### Financial Briefs

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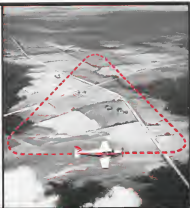
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# WING TIPS

## WHEN LOST IN FLIGHT —EMERGENCY PROCEDURE

If you're ever lost, here's what to do: **WITH RADIO CONTACT:** Tune to emergency frequency 121.5 mc. Fly a triangular pattern to the right in 2 minute legs with  $1\frac{1}{2}$ ° per second turns of 180°. Complete a minimum of two patterns before visualizing course. If radar contact is established, instructions will be given on 121.5 mc. **NO RADIO CONTACT:** Fly a triangular pattern to the left in the manner described above. If radar contact is established, a Search & Rescue plane will be dispatched for interception. Recognition of course will not compromise this system as your plane will continue to be tracked as "detoured" from the point of initial radar contact. If possible, repeat the procedure each 30 minutes until instructions are received or interception by Air Rescue Service is accomplished.



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## BUSINESS FLYING



THIRD PROTOTYPE of first purpose German turbine-powered helicopter, the SM 67, is built by Messler Flugzeugwerke GmbH.

## SM 67 Completing Initial Flight Trials

By Edith Walford

Gelberts, Germany—Third prototype of the first SM 67 SM 67 helicopter built by Messler Flugzeugwerke GmbH and manufacturing Germany's first turbine-powered main rotor aircraft is now completing its initial flight tests here. The company began development of the SM 67 in 1946 as a general purpose independent venture. Subsequently, the West German Defense Ministry became interested in the project and provided it with financial support.

First prototype is a utility version with a welded steel tube fuselage. As in July 1959, but was severely damaged during ground tests the following month (AW Sept. 14, 1958, p. 72).

The second model, completed toward the end of 1959 and incorporating several modifications, has remained as experimental aircraft. The present third prototype SM 67 is powered by a Turbomeca Artouste 2C engine rated under standard conditions at 493 chp. It replaces the Turbomeca Artouste 2B turbine used at 164 chp, which powered the experimental SM 67 version. The engine is fitted with an automatic independent speed regulator, which keeps the same speed constant even though the engine power can be reduced. It also allows the use of a hand-operated

throttle lever which is often handy for the pilot. The steering unit has a hydraulic power amplifier to reduce vibration on the control stick.

### Rotor Head

The rotor head is fitted with interchangeable metal blades constructed to Messler's own design. Both the blade carrying parts and the axle due to the helicopter are of lightweight bonded metal construction to avoid vibration. The rotor head is also fitted with a drive shaft which is made of steel. The rotor head is provided for optional deicing equipment.

The SM 67 is a multi-purpose heli-

copter. Standard version is a pilot plus four-passenger configuration for business flying and touring. Equipment is available to adapt the aircraft to a wide variety of additional uses such as a transport with dual controls, an ambulance capable of carrying two stretchers and a medical attendant in addition to the pilot for agricultural, topographical or cargo-carrying duties.

Design of the welded steel tube framework of the fuselage is used to increase the helicopter's performance in both forward and backward flight conditions. This front-door glass cockpit allows the reconstructed, all-round view. The main rotor assembly, gear train, powerplant, fuel tanks and trans-



MESSLER SM 67 turbine helicopter is powered by a Turbomeca Artouste 2C engine rated at 493 chp. It is now being flown after taking on its initial flight on Aug. 12.



**FROM  
THE "JENNY"**

**TO THE JETS**

**SINCLAIR HAS SERVED AVIATION,  
BOTH COMMERCIAL AND MILITARY, AS A PRIME SUPPLIER  
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OF RELIABILITY.**

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SM 67 Specifications	
Seating capacity	2
Powerplant	1 Turbomec Artouste 1C
Maximum speed	1400 rpm
Maximum power output	400 hp
Maximum power output	1300 hp
Dimensions	
Span including rotor	41.52 ft
Height	9.58 ft
Width of fuselage	5.80 ft
Rotor	
Number of blades	3
Rotor diameter	34.4 ft
Rotor pitch mechanism	315 rpm
Tail rotor	
Number of blades	2
Rotor diameter	6.40 ft
Director unit	adjustable for without rotor
Blades removable	fixed for without rotor
Landing gear	two main wheels one tail wheel
Weights	
Empty weight	2250 lbs
Useful load	1400 lbs
Gross weight	3740 lbs
Performance (at)	
Top speed (400 hp)	350 mph
Cruising speed (500 hp)	115 mph
Rate of vertical climb (1000 hp)	18.15 ft/sec
Rate of forward climb	29.5 ft/sec

ing gear are located in the middle of the fuselage-chassis (pod) unit and tail rotor in the rear fuselage section.

The pilot and one passenger sit side by side in the two front seats of the cabin, the three other passengers sit side by side, alternately behind the front seats. Thus, this is roomy in the cabin for a loaded amount of baggage. By removing the three rear seats the helicopter can accommodate two children for rescue work.

The three-seat and passenger pod is installed so as not to interfere with the pilot's view and provision is made for dual controls. A combined pressure-vent conditioning and cabin heating system is installed and has a gaspacer and fuel oil fan are removable both from within and from outside the cabin. A soundproofed firewall screens the cabin from the power unit. Parts detachable until coming with bags allow easy access to the propeller and steering unit. The rear fuselage section is built around with a lightweight metal skin.

The rotor head is fixed with three rotor blades. Control hub is a fixed over a console of known bars is adjustable. Blade changing is operated hydraulically and the blades pivot have fixed and rear helicopter fittings to limit or adapt these blades.

Rotor blades are of lightweight bonded metal construction. They are detachable and the profile is constant throughout the entire blade length.

Both the adjustable elevator unit and the fixed rotor assembly are of light-weight metal construction.

The main rotor has three blades and two variable metal blades attached to the main gear on the rotor assembly and is actuated over another rotor gear in direct fixed pitch transmission by the main rotor.

Landing gear consists of two slats supported by two flexible cross bars attached to the middle section of the fuselage. The main bars and the hydraulic damping unit in refinishing forward landing. Four fitted flexible struts increase the resistance of the landing gear in case of a hard landing. Two retractable wheels serve to raise and lower the helicopter on the ground.

A flexible tail shaft allows good ground clearance of the tail rotor during a pull-out of the helicopter of up to 10 deg.

The steering unit has a hydraulic power cylinder to assist the force of the control stick and controls, and stabilizers. The helicopter can also be mechanically controlled should the hydraulic cylinder not act. The steering unit is attached to the stick and control pedals the same as on any other aircraft. An optional pitch control lever can be placed at the rotor blades through the control stick assembly.

## Argentine Ordering 81 Rallye Aircraft

Paris—Argentine government order for 81 Mooney-Sinclair Rallye aircraft has been ordered by the French company's Rallye order backlog over the 100 in all.

Argentine order was signed by the Vice Admiral Delfino del Puerto. The main aircraft ordered were built for the contract with for one completed aircraft 10 in large assembly and the balance in component parts. Delfino will also handle Rallye sales in Argentina.

In mid-June Mooney had booked 114 Rallye series of which 165 were standard series in 27 foreign countries. Half of the orders are placed about equally in the 100 hp Super Rallye and 145 hp Rallye 255. Only 10 orders have been placed for the 80 hp Rallye model.

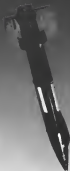
In September Mooney intends to bring a Super Rallye to the U.S. for demonstration flights. The visit originally scheduled for May was postponed following a violent accident on the 82 Rallye prototype. French company, incidentally, is still seeking a partner for its U.S. sales effort.

acknowledges the 8 and a factor in the considered in any other is the low overall cost of reliable rotors delivered on time versus the apparent cost of less prior bids. An acknowledgment is made for the use of local design for aircraft, mooring, and engine installation. *Roller roller unit 1251 First St., San Francisco, Calif. TEL 900-3000. Representatives throughout U.S. & Canada.*





TO THE EDGE OF SPACE...



AND BACK

Northrop's Q-Ball, "hot nose" for the X-15, provides flight angle data to the pilot during the critical exit and entry phases of the history-making flights to the edge of space. This permits him to correct his angles of attack and sideslip to avoid the intense frictional heat limits. Q-Ball was developed by the Nortronics Division of Northrop under contract to the National Aeronautics and Space Administration.

**NORTRONICS**  
A DIVISION OF  
**NORTHROP**











an speed below 1200 ft. The design depends on the aircraft. If however the stall occurs, reduced coordination becomes necessary depending on amount of difference between the two engines. More specifically, the data show that if the difference is reduced to more than 5 ft/sec, the stall probably will occur. When stall occurs, a stall warning will sound, and the engine will be shut down. The stall warning will sound when the engine is at a speed of 1200 ft/sec.

In conclusion, the design of the aircraft depends on the stall warning. The stall warning is a warning light, and the stall warning is a warning light, and the stall warning is a warning light.

more, 250 loads at the time of the accident, the design of the aircraft depends on the stall warning. The stall warning is a warning light, and the stall warning is a warning light.

One possibility is that in preventing the stall warning, the stall warning is a warning light, and the stall warning is a warning light.

point at the proper frequency to coordinate engine damping. The engine damping is a warning light, and the stall warning is a warning light.

A second possibility is that the stall warning is a warning light, and the stall warning is a warning light.

A third possibility appears to be that the stall warning is a warning light, and the stall warning is a warning light.

#### Chicago Landing

The landing of N 12115 at Chicago on the day of the accident may well have caused damage to the wing structure even though some of the passengers considered it a perfectly normal landing. They were not to be far from the truth when they considered the number of the wing structure and that it was of the order of 100,000 ft/sec. The wing structure is a warning light, and the stall warning is a warning light.

In conclusion, the design of the aircraft depends on the stall warning. The stall warning is a warning light, and the stall warning is a warning light.



## Immediate Minuteman and Dyna-Soar openings for Electronic and Electrical Engineers

Electronics is one of the fastest growing areas of engineering at Boeing. Electronic and electrical engineers interested in the advancement of space-age technologies will find challenging and deeply rewarding opportunities in advanced Boeing programs, including the Dyna-Soar manned space glider and the solid-fuel Minuteman ICBM. Assignments exist in your particular area of interest and at the level you require for career satisfaction and advancement. For your convenience, a professional application form appears at the right, and continues on the following page.

RETURN TO MR. W. B. EVANS  
THE BOEING COMPANY  
P.O. BOX 3707 AWC  
SEATTLE 26, WASHINGTON

#### PROFESSIONAL PORTION APPLICATION (All replies held in strict confidence)

Date of this Application \_\_\_\_\_

Name \_\_\_\_\_

Social Security No. \_\_\_\_\_

Present Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

Telephone No. \_\_\_\_\_

Do \_\_\_\_\_ Sex \_\_\_\_\_ Age \_\_\_\_\_ U.S. Citizen \_\_\_\_\_

Male \_\_\_\_\_ Female \_\_\_\_\_ Marital Status \_\_\_\_\_

No. of Children \_\_\_\_\_ Other Dependents \_\_\_\_\_

U.S. Veterans \_\_\_\_\_ Entry Date \_\_\_\_\_

Discharge Date \_\_\_\_\_

Type of Discharge \_\_\_\_\_

Spouse's Maiden Name \_\_\_\_\_

Employer \_\_\_\_\_

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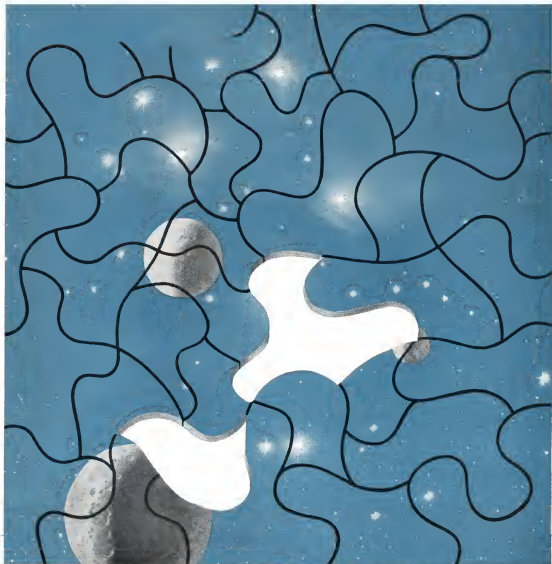












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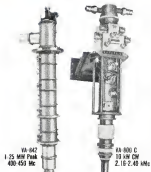


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